MUNICIPAL ENGINEERING

VOLUME XXXVIII. JANUARY, NINETEEN HUNDRED TEN. NUMBER ONE

TOWN SCAVENGING AND REFUSE DISPOSAL.

STREET CLEANING.

By Hugh S. Watson, A. M. I. C. E., London, England.

THE methods adopted for the cleansing of the various classes of pavement are very similar all over England, but as each class requires a separate method it will be best to consider them in detail.

Asphalt, Wood Paved and Tar Macadam Surfaces in Towns.—Surfaces composed of these materials are the most easily cleaned, since they can be swilled down with water. The process is generally as follows: A water cart passes along the streets in order to damp down the surfaces, and so make it easier to collect the larger solid particles. A gang of men accompanied by carts then pass along and pick up the rough stuff, in order that there may not be too much solid matter to be removed by the subsequent flushing, as the whole of the flushing water passes into the sewers, so that if these precautions were not adopted there might be a risk of silting them up. After this has been done, the flushing is carried out by means of hose attached to hydrants. This is undoubtedly the most satisfactory way of dealing with streets subject to heavy traffic. The difficulty of sweeping up horse droppings which may have been passed over by heavy motor vehicles and may have become saturated with oil from them is very considerable, but the great pressure obtainable by the use of the hose pipes renders it a comparatively easy matter.

In London the water required for street flushing is obtained from the mains of the Metropolitan Water Board, the ordinary fire hydrants mostly being used as a means of supply. There are, however, several disadvantages to this arrangement, as it is necessary to notify the fire department of the London County Council when the hydrants will be required, in order that they may send an employe to turn on the water, and also to note the length of time during which the water is being drawn, as the water is paid for in bulk, the consumption being calculated from the pressure and the size of nozzle used. In order to avoid these inconveniences, some of the Metropolitan boroughs have special flushing hydrants, from which the water is drawn by their own employes, the consumption being registered by meter. The cost of the water is sixpence per 1,000 gallons. It is very difficult to make any comparison as to the cost of street cleaning by this method, as it depends entirely on the nature and extent of the traffic which passes over the roads.

Thus, in the city of London, which has an area of 650 acres, the quantity of water used during 1907 for night washing and flushing streets, courts and alleys was 77,424,000 gallons, and the cost £1,935, the number of nights on which the water was used being 303. The actual cost of flushing wood and asphalt paving is estimated at about 7d. per superficial yard per annum, for six nights per week.

In Sheffield the cost per superficial yard works out at about 4.02 pence for 200 times per annum.

As showing how the nature of the traffic may affect the cost, it may be mentioned that in Finsbury a gang consisiting of one nozzle man and four helpers can only clean about 600 lineal yards of road, thirty feet wide, equal to 6,000 square yards, in 9½ hours, while in Sheffield a gang composed of a turncock, a nozzle man and a helper can clean about 15,600 square yards in 7 hours.

The helpers are provided either with "squeegees" or brushes, with which they drive the debris into the gutters,

whence it is conveyed by the flow of water into the sewers or surface gulleys. If the matter is conveyed to gulleys, these should be emptied immediately the flushing has been completed. In many of the London boroughs the roads are swept down a second time in the early hours of each morning, the main cleaning being done from about 8 p. m. onwards, depending upon the district.

Asphalt, Wood Paved and Tar Macadam Surfaces in Outlying Districts.—In districts where they are not subjected to very heavy traffic, these surfaces can be cleansed more economically by rotary sweeping machines than by flushing with water, owing to the rapidity with which the machines can be driven.

The work is generally carried out in the following manner: A water cart is first sent along in order to allay the dust. The machine sweeper is then driven down the center of the street, and brushes the sweepings to one side, the brushes being placed at an angle to the axis of the machine. Each time the machines pass along they carry the sweepings a little closer to the edge of the road, and the process is continued until they have all been left in a long line down the side of the road, the exact number of journeys required to accomplish this depending upon the width of the road. These machines are very economical for cleaning asphalt, wood paved and tar macadam surfaces, as they are capable of cleaning about 8 miles of road, 30 feet wide, in 9½ hours, and only require the attendance of one man to act as driver. They are, however, unsuitable for roads having plain macadam surfaces, as the brushes tend to loosen and remove the binding material. As soon as the material has been swept into line, gangs of sweepers pass along on either side of the road and brush it into small heaps. Slop collecting wagons follow the gangs, and the material is placed in them and removed as speedily as possible. The sizes of the sweeper gangs will vary in different districts, depending upon the heaviness of the traffic over the roads. In the London districts it is found necessary to detail a ganger and six sweepers to every machine, whereas in Sheffield four sweepers have been found sufficient.

These slop collecting wagons are usually made to hold about 4 cubic yards of matter, but the exact amount that can be carried depends upon the state of the weather; in wet weather no more than 3½ cubic yards can be taken, while in dry weather as much as 4½ cubic yards can be carried, the average weight of a load being about 2 tons. It is not generaliy advisable to exceed this weight, as the strain put upon the horses becomes too great. With a 2-ton load and a journey of from 1 to 1½ miles each way, a cart is capable of taking about 4 loads per night.

In some towns, as in Leeds, the method is slightly altered. The machine sweepers are started about midnight and the sweepings are left in long lines at either side of the roads until about 6 a. m., so that any water may drain away. At this hour the cleaning gangs start to sweep the matter up into small heaps, and they are followed at 6:30 a. m. by the carts and horses, which remove the heaps prepared for them. The work is completed by 2:30 p. m. This system is unsuitable to the requirements of London, owing to the very early traffic in the neighborhood of the markets, and not only have the streets to be cleaned during the night, but during the winter months it is very often necessary to start shingling [sanding] the roads soon after 3 a. m. for the purposes of this traffic.

Macadam Surfaces.—Macadam roads are in all cases swept entirely with hand brooms. The process varies in different towns. In some cases the gangs are sent out each with its own cart or carts, as the case may be, while in others men are told off to clean different streets, and the carts make their rounds independently, collecting the matter that has been swept up. As in most large towns macadam surfaces are only in use in the outlying districts where the traffic is comparatively light, it is generally possible to do this work during the day-time. If the men are sent out in gangs, it is generally advisable to keep them small, having one ganger to every six or seven men, in order that they may be kept well under observation.

In Dover the town is divided into districts, and each district is swept by a gang of three scavengers with one cart.

The method adopted at Kingston-on-Thames is as follows: The town is divided into four wards, and the street cleaning in each ward is carried out by a ganger and four scavengers. The men are not allowed to work together in a batch, but are each given certain roads to clean, the basis being roughly one man per mile per day. By this arrangement Mr. Clucas, the borough engineer, considers that the men waste

less time in loitering than when they are sent out in batches, and there is no risk of any road being overlooked, it being the duty of the ganger to see that each man cleans the roads allotted to him. The men scrape the sweepings in to small heaps, which they leave at the roadsides, and collecting carts are sent around after each one to remove them.

In districts where the traffic is heavy it is preferable to employ young men for this work, as they are less liable to injury by passing vehicles than older men.

Cleansing of Courts and Alleys.—Courts and alleys are sometimes cleaned by flushing, but more often they are swept with hand brooms. This work offers very suitable employment for the older men, as they require less supervision than younger men, and if once made to understand what is required of them, can be entrusted to carry out the work in a satisfactory manner.

RESISTANCE TO WEAR OF MATERIALS FOR SEWER INVERTS.*

By Edward S. Rankin, Engineer Sewer Department, Newark, N. J.

IN examining brick sewers built 20 to 30 years ago it frequently happens that the bricks in the invert are found nearly or quite worn through. This is particularly noticeable in sewers with a fairly steep grade and carrying a considerable amount of street wash. I have in mind particularly one sewer about 6,000 ft. in length, built in 1873, where practically the entire invert has had to be renewed, a troublesome and expensive operation. The following quotation is taken from Folwell's "Sewerage": "A 5½ ft. two-ring brick sewer in Baltimore, 25 years old, was recently found with its invert in one place cut completely through for a width of 12 to 15 ins., and badly worn for a height of 2 ft. In Omaha's brick sewers the wear, which is usually 18 to 24 ins. wide, became 2 to 3 ins. deep in 12 years."

In order to avoid this trouble it has been our custom for a number of years past to line the lower third or quarter of the sewer with vitrified paving brick. The only test required for these paving brick in our specifications is that they shall not absorb more than 2 per cent. of their weight in water after being thoroughly dried and then immersed for 24 hours. Is this test a criterion of their wearing qualities in the sewer? And is the life of the sewer increased sufficiently to warrant the extra cost? Wiithin the past few years we have also built a number of concrete sewers, lining their inverts also with paving brick. The writer has heard the statement made that on some of the very steep grades in the city of Duluth sewers were found in which the brick was nearly worn away but the cement joints were left with almost their original thickness. If this is the case, is a vitrified lining necessary in concrete sewers? Another question along the same line is the relative wearing qualities of a concrete as compared with a vitrified pipe. The following experiment was made in the hope of throwing some light on the above questions.

The several samples selected were first tested for absorption and then placed on a rubbing bed such as is used in stone yards for smoothing blocks of stone. They were all given a uniform weight of 20 lbs. and were left on the bed for 30 minutes. The velocity of the bed on the line on which the samples were placed was 21 ft. per second.

The results are shown in the accompanying table. Numbers 1 to 4 were vitrified shale paving brick selected for their variation in absorption. No. 5 was a small shale brick made for use in sewers. Numbers 6, 7 and 8 are different makes of building brick also selected for their variation in absorption. Numbers 9, 10 and 12 were made from the mortar and concrete being used in the construction of a sewer at the time the experiment was made and were tested when 18 days old. No. 11 was a section of concrete pipe furnished by the Lock Joint Pipe Company of New York, and was approximately one year old. No. 13 was a tile used by the same company for lining their pipe where required by engineers. Numbers 14 and 15 were samples of vitrified salt-glazed sewer pipe.

*A paper before the American Society of Municipal Improvements.

The second column of the table, per cent. lost by abrasion, was obtained by dividing the weight lost on the bed by the original weight, assuming each sample to be of a uniform size, 2x4x8 ins. The last column assumes arbitrarily the life of the softest sample, No. 8, to be 10 years and calculating the others from this.

While this experiment is not to be considered by any means as giving absolute or final results, it appears to show, first, that for similar materials, although there is a considerable variation in the ratio, the abrasion in every case, with the exception of No. 12, increases with the absorption, and hence the absorption test gives a fair idea of the wearing quality of the material; second, the additional cost necessary to line the invert of a brick sewer with paving brick is certainly warranted, although the 2 per cent. test required by the Newark specifications seems unnecessarily severe; third, the concrete samples compare favorably with the paving brick, and it would therefore seem unnecessary to line a concrete sewer. The behavior of the mortar sample also bears ou the statement as to ordinary brick wearing away faster than the cement joints. I am unable to account for the low figure shown by the stone concrete. The sample was made at the same time as Nos. 9 and 10, the stone being New Jersey trap rock. Fourth, the tile pipe is apparently not quite as durable as good concrete pipe, and the use of the lining tile is superfluous.

No.	Material	Per cent gained by absorption.	Per cent lost by abrasion.	Ratio of absorption to abrasion.	Life of invert in years.
1	Vitrified shale brick	1.36	2.00	1:1.47	324
2	Vitrified shale brick	2.15	3.35	1:1.56	193
3	Vitrified shale brick	3.60	3.42	1:0.95	189
4	Vitrified shale brick	4.28	5.92	1:1.38	109
5	Shale sewer brick	13.18	27.31	1:2.07	24
6	Building brick	7.39	20.41	1:2.76	31
7	Building brick	10.19	44.74	1:4.39	15
8	Building brick	18.91	64.74	1:3.42	10
9	1:2 cement mortar	11.86	4.41	1:0.37	147
10	1:2:4 gravel concrete	6.65	3.82	1:0.57	169
11	1:2:4 gravel concrete	5.10	3.35	1:0.66	193
12	1:2:5 stone concrete	7.40	8.62	1:1.16	75
13	Vitrified tile	1.34	4.47	1:3.34	145
14	Vitrified pipe	4.47	6.11	1:1.37	109
15	Vitrified pipe	1.72	4.55	1:2.65	142

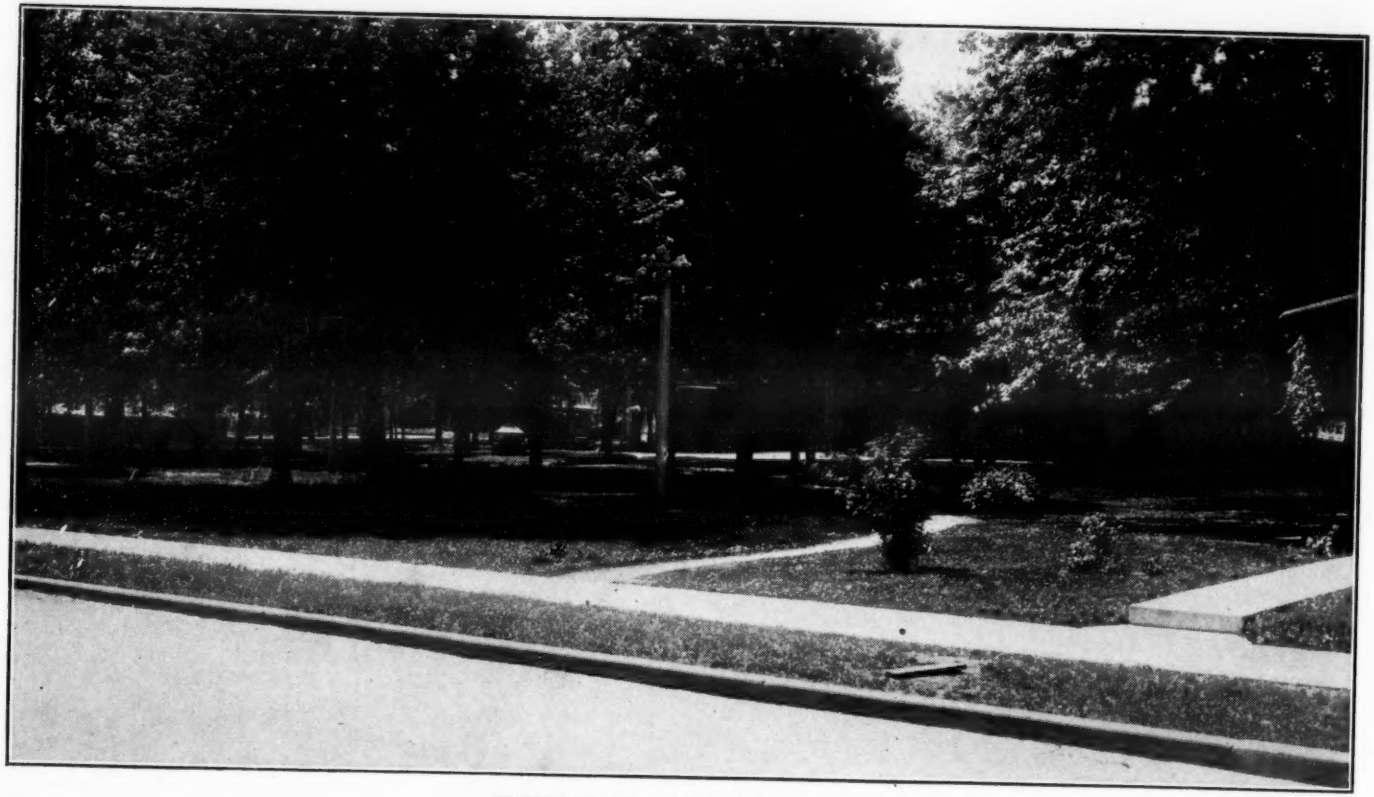
THE WATER WORKS OF MARION, IND.

By Elkanah Hulley, Superintendent.

THE history of the water works of Marion, Ind., is typical of that of many of the water works plants of the smaller cities of the west. One has been prepared by Elkanah Hulley, superintendent of the works, whose family has been connected with the management of the works most of the time since the beginning. The following is abstracted from his history, for which, and for the accompanying photographs, we are indebted to Mr. Halley:

In the early days of Marion all the fire protection was by "bucket brigade," to which all residents, both men and women, belonged. It was not until the town had been visited by some serious fires that a Babcock fire extinguisher was purchased. In 1875 all the buildings on the west side of the square, between Third street and the alley between Third and Fourth streets, were destroyed by fire. And in January, 1876, all the buildings except one on the west side of Washington street north of Fifth street and south of the alley between Fourth and Fifth streets were burned. Then began the first real earnest agitation for a water works system, the late Samuel Hulley being the prime mover in creating sentiment in favor of it.

After considerable agitation a petition was circulated and signed by three hundred and forty-five citizens, representing five-eighths of the taxable valuation of the property of the town, and presented to the town trustees June 20, 1876, praying that a debt be contracted and bonds issued to the amount of $35,000 for the purpose of



WATER WORKS PARK, MARION, IND.

establishing a system of water works for fire protection and furnishing water for domestic purposes.

On August 23, 1876, an ordinance providing for the construction and for the issuing of bonds was passed. J. D. Cook prepared plans, the contracts were awarded on October 25 and November 7, and January 17, 1877, a lot was purchased upon which to locate the buildings and well.

September 29, 1877, Mr. Cook made his final report on the completion of the contracts, and called attention to the purity of the water and the ample supply from the well.

The cost of the plant to May 1, 1878, was as follows:

28,356 feet of pipe, with 26 valves, 40 hydrants, laid and set complete	$21,931.70
Engines, pumps, engine house and well	11,380.00
Boring well, grading lot, well house and all other incidental expense	1,394.65
Total	$34,706.35
Less material on hand	3,156.12
Net cost	$31,550.23

In August, 1880, the trustees purchased 4 lots and a tract of land in the southeast corner of the present water works park. In 1885 the board bought 5 more lots, extending the park north to Seventh street and west to Whites avenue, constituting the present water works park.

The first well contracted for was a dug well twenty feet in diameter and twenty-five feet deep, walled with brick. Sufficient water was not obtained at this depth, and two six-inch wells were drilled to a depth of about sixty-eight feet in the bottom of the dug well. After passing through an extremely hard hard-pan a fine flow of artesian water was secured in a water-bearing stratum of gravel.

This supply was sufficient for the needs of the town for a number of years. But a great deal of trouble was experienced from the gravel and fine sand choking up the casing of the wells. The water would rise to a height of about twelve feet above the surface of the ground, and was of an excellent quality.

As the town grew and a greater supply became necessary to meet the demands, a contract was awarded to the National Water Supply Company for sinking and connecting a series of six wells direct with the suction pipe of the pumps. These proved in most part a failure on account of fine sand getting into the pumps and choking up the Cook strainers on the bottom of the well casing. Many other wells were drilled, and all encountered the same trouble, and it was not until after the drilling of gas wells that the lower stratum of water was found in rock. The trouble then from sand and gravel seemed to be at an end.

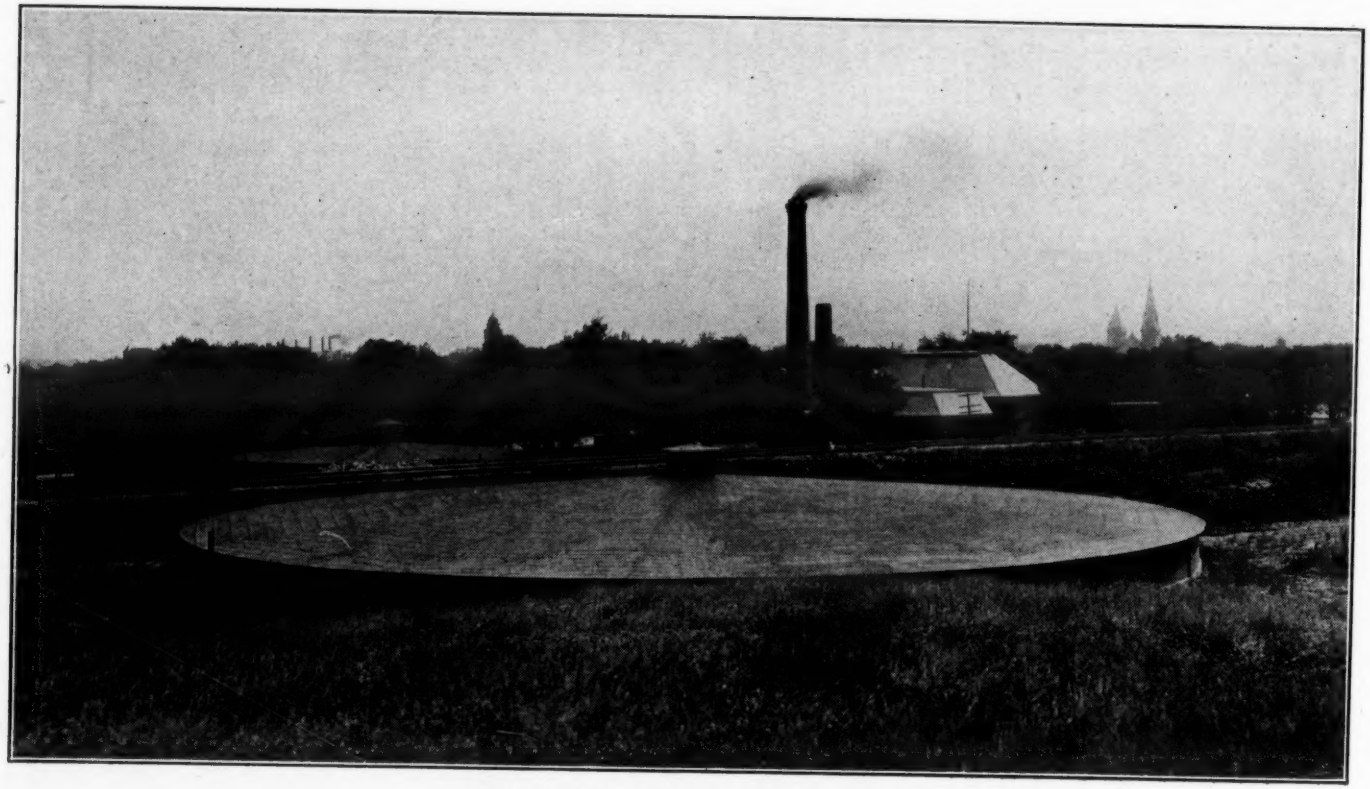
The first of the deep or rock wells brought into use was what is known as the Kiley well. This was secured at a time when the water supply was almost exhausted, and was a great relief. Following this a number of wells were drilled, some being pumped by air and others by deep well pumps. Nine wells furnished a sufficient supply until 1903, when well sites were leased from Asa T. Baldwin on Valley avenue, and a sixteen-inch pipe laid to convey the water by gravity to the pumping station. There are five wells now located on the Baldwin lease, making in all fourteen wells, which furnished an abundance of water during the summer and fall of 1908, which was the dryest season since the establishment of the water works. All the wells in use are drilled into limestone and the drift cased off with eight-inch casing, and are from one hundred and twenty to three hundred feet deep, and all are pumped by air lift.

The first pump installed was made by Dean Brothers, of Indianapolis, and had a capacity of 1,500,000 gallons in twenty-four hours, and was the only source of fire protection for the town until July, 1888, when the water works trustees contracted for a Dean duplex pump, with a capacity of 2,275,000 gallons, which was used as a reserve while making repairs on pump No. 1.

The third pump installed was a Fairbanks-Morse compound non-condensing, with a pumping capacity of 4,000,000 gallons per day, and was placed in commission in 1894, taking the place of pump No. 1. This pump was in almost constant service until July, 1902, and is now used as a reserve only.

The Fairbanks-Morse pump being the only one with sufficient capacity to be of service during a fire, the committee decided to install a larger pump and also an air compressor. The buildings being too small to house the new machinery, J. D. Cook prepared plans, and on April 30, 1901, contracts were awarded for reconstruction of buildings, pump and air compressor, laying water mains, boiler, and foundation for machinery.

The Snow Steam Pump Works in-



WATER WORKS PLANT OF MARION, IND.
Reservoir holding 2,000,000 gallons in foreground.

stalled a horizontal three-crank triple-expansion high-duty pumping engine, with a capacity of 5,000,000 gallons in twenty-four hours, which was put in operation in July, 1902, and has been in constant service without any expense for repairs on the engine or pump to the present time.

With the increase in population and the greater consumption of water, it became necessary to secure more wells and a means of pumping them. Previous to this time deep well pumps had been used for this purpose, but as the new wells were located further from the plant, it was decided to purchase an air-compressor, and in June, 1895, a contract was entered into with the Hall Steam Pump Company, of Pittsburg, for a 16x20x18-inch air compressor, which, with the deep well pumps, were used until July, 1902, when the present Laidlaw-Dunn-Gordon 15x25x20 x24-inch cross compound machine was installed by the Bacon Air Lift Company, which took the place of the first compressor and all the deep well pumps, and is now pumping fourteen wells. While pumping water with air lift is expensive, this machine has given entire satisfaction and has cost practically nothing for repairs in the six and one-half years it has been in service.

Three changes in boilers have been made since the installation of the plant, each time with an increased horse-power capacity. At present there are one 300-horse-power Stirling water tube boiler and two 66x18-inch tubular boilers with 6-inch lap-welded tubes, the latter boilers being used only while cleaning the former, which has been in service seven years and is reported by the boiler inspector in first-class condition.

Reservoir or well No. 1, 25 feet deep and 20 feet in diameter, was the dug well contracted for by Dean Brothers in their original contract. It has a holding capacity of 58,900 gallons. The suction pipes from the pumps are connected to this well, and the water from the other reservoirs is brought into it by gravity.

Reservoir No. 2, 13½ feet deep and 53 feet in diameter, will hold 224,000 gallons, and was constructed in 1891. It was considered of ample capacity for all purposes at that time, but as the population increased L. M. Overman, city engineer, prepared plans for reservoir No. 3, which was constructed in 1896. This reservoir is 15 feet deep and 94 feet in diameter, and has a holding capacity of 750,000 gallons.

The consumption became greater than the capacity of the wells in the day time, and it was often necessary to draw on the reserve to such an extent that had a fire broken out it would have been taxed to the limit and possibly exhausted.

This fact being evident, City Engineer Thomas E. Petrie prepared plans for reservoir No. 4, and the contract was awarded on September 5, 1905, at $10,400. On July 9, 1906, the contract for the roof was awarded at $3,750. Its location is on the south side of the P., C., C. & St. L. railroad and the crossing of Whites avenue. It is 16 feet deep and 152 feet inside diameter, and has a holding capacity of 2,000,000 gallons, and is fed by two wells in such a way that the water is in constant motion. The overflow is taken from the bottom, and the water is practically changed every eight days.

All the reservoirs are covered and kept under lock and key, insuring a pure, clean supply of water.

Summary of receipts and expenditures since the installation of the plant to February 10, 1909:

Received from tax levy for payment of bonds, interest and extensions	$197,336.80
Total receipts from water rents	332,592.85
Total receipts	$529,929.65
Applied on payment of bonds issued and redeemed	$84,000.00
Interest paid on bonds and loans	54,752.50
Applied on extensions	180,661.89
Applied in operating and repairs	202,611.36
Cash on hand Feb. 10, 1909.	7,903.90
	$529,929.65

The cost of the plant is as follows:

Bonds issued and redeemed	$84,000.00
Interest paid on bonds and loans	54,752.00
Received from taxes applied on extension	58,584.30
Water rent receipts applied on extension	122,077.59
Outstanding 4 p. c. bonds	38,500.00
Total cost	$357,914.39

The water works plant is entitled to the following credits for service and cash for which it has received no returns:

Water rent receipts applied on extensions shown above	$122,077.59

WATER WORKS PARK, MARION, IND., IN WINTER.

Saving to city in hydrant rentals over private plant at $55 each per annum...	290,400.00
Saving to consumers of 56 per cent. lower rent than if owned by private company	186,251.99
Seventeen years free water to city light plant, $75 per year	1,275.00
	$600,004.58

Free list for which credit has not been taken: Fourteen school buildings, city library, all of the churches, Young Men's Christian Association, Emily E. Flinn Home, five fire stations, seventeen drinking fountains, city hall, water for street cleaning, water for building streets and sidewalks, sixteen automatic flush tanks for sewers.

In arriving at the saving to consumers in water rentals, the average of twenty cities in Indiana, with private water plants, was taken, and, based on a dwelling of six rooms, with house use, bath and closet, was found to be, average, $13.26; Marion, $8.50. For house use only, average, $5.93; Marion, $4.

Average meter rate per 1,000 gallons in twenty cities as above: Maximum, 30 cents; minimum, 10 cents. Marion: Maximum, 15 cents; minimum, 6 cents.

Number of consumers: Flat rate, 2,808; meters, 492; hydraulic elevators with counter, 2.

Water rent receipts have increased from $21,336.53 in 1903 to $28,513.20 in 1908. The total for the six years is $152,993.19, which has been applied as follows:

Transferred to extension bond and interest fund...	$68,639.99
Operating, repairs and salaries	77,608.10
Cash on hand.....	6,745.10
	$152,993.19

The average pumpage of water has increased from 1,306,799 gallons a day in 1903 to 1,547,849 gallons in 1908.

An inventory of the plant shows a total valuation of $282,440.40.

Size and number of feet of distributing mains are as follows: 20-inch, 696 feet; 16-inch, 1,320 feet; 12-inch, 1,650 feet; 10-inch, 9,284 feet; 8-inch, 6,305 feet; 6-inch, 156,690 feet; 4-inch, 30,788 feet. Total number of feet, 202,733.

The water works plant is self-sustaining, the income meeting all expenses of operating, payment of bonds and interest, and making extensions.

GAS AND ELECTRIC COMPETITION ABOUT BOSTON.

By Alton D. Adams, Worcester, Mass.

CONSOLIDATIONS just authorized by the gas and electric light commissioners, of Massachusetts, will promote gas and electric competition about Boston.

Under a decision of the commissioners dated August 20, 1909, the Edison Electric Illuminating Company, of Boston, is authorized to purchase the electric locations and properties of the Boston Consolidated Gas Company, the Newton and Watertown Gas Light Company and the Waltham Gas Light Company, used in the business of generating and furnishing electricity for light and power.

The Newton and Watertown Gas Light Company is by the same decision authorized to purchase the gas franchise and property of the Waltham Gas Light Company.

By these purchases the service area of the Boston Edison Company, which now includes most of that city, besides Somerville and Woburn, and twenty-two towns, is extended over the Back Bay and Brighton districts of Boston, the cities of Chelesea, Newton and Waltham, and the towns of Brookline and Watertown.

The Newton and Watertown Gas Light Company will extend its gas supply over Waltham, and there is pending before the commissioners a petition for the consolidation of the East Boston and Chelsea gas properties, this consolidation being contingent on the approval of the Edison purchase of the Chelsea electric property.

For the electric property and locations of the Boston Consolidated Gas Company the Boston Edison company is to pay $1,300,000; for those of the Newton company, $500,000; for those of the Chelsea company, $350,000, and for those of the Waltham company,

$600,000. The Newton company is to pay $500,000 for the gas franchise and property of the Waltham company.

Material reductions in electric rates are to follow these consolidations, for the maximum net rate of 12 cents per kilowatt hour now charged by the Boston Edison company is to apply at once over the added area, and this rate is to be lowered to 11 cents per kilowatt hour not later than January 1, 1910.

The present maximum net rates of the several purchased electric plants are as follows, per kilowatt hour: Boston Gas Company, 14 cents; Newton company, 12 cents; Chelesa company, 15 cents, and Waltham company, 16 cents. The Newton rate was reduced from 18 cents in anticipation of the sale to the Boston Edison company.

In Newton and Waltham the gas rate is to be reduced from the present price of one dollar to 95 cents per thousand feet, on or before January 1, 1910. It has been further stipulated, though this fact does not appear in the above opinion of the commissioners, that if the East Boston and Chelsea gas companies are permitted to consolidate, per their pending petition, the net price of gas in the area supplied by these two companies will be reduced from the present rates of $1.00 and 95 cents to 90 cents per thousand feet, on January 1, 1910. More than this, the company will, on January 1, 1911, take up with the commissioners the question of further change in the rate.

Among the reasons given for their decision in favor of the above consolidations the commissioners say:

"In the light of the progress which has already been made both in the gas and electric business,, it is clear that gas and electricity can be profitably supplied over far wider areas than was formerly thought feasible. It is equally clear that greater efficiency in operation and greater economies in investment and operating costs are possible in a large gas or electric plant serving a given territory than to several independent small plants serving different sections of the same territory. Experience also indicates that there is a public advantage in communities of the size of those now under consideration in having the gas and electric business separately conducted and under independent management and control. The two kinds of business are so far competitive that the natural rivalry between the two is stimulating to both managements, and should result in substantial benefits to the public."

"Compared with that of the Edison company, the electric business of all the others named is small in volume, less varied in character and transacted at substantially higher prices. When the volume and character of the business of these companies are considered, it may safely be assumed that the Edison company can readily supply electricity in the several territories of the other companies at lower costs and charges than any of these companies could reasonably be expected to do."

While gas and electric properties are being consolidated in many parts of the United States, it is especially worthy of note that just the opposite process is going on in eastern Massachusetts.

THE CARE OF SURFACE WATER AT STREET INTERSECTIONS.*

By S. D. Newton, City Engineer, Knoxville, Tenn.

ONE of the most serious problems with which the street builder has to reckon deals with the care of water at intersections. Failure to adequately provide for storm water may easily cause overflows onto adjacent property and entail damage suits against the city for sums which in extreme cases may equal or even exceed the original cost of building the street. Water standing for any proportion of the time upon the street surface will cause deterioration in the material of which the surface is constructed. With a bituminous street such deterioration is accomplished in a comparatively short time; with a wood block street, unless most thoroughly impregnated with creosote oil, decay may be more rapid still; while even with a stone, brick or concrete street standing wa-

*A paper before the American Society of Municipal Improvements.

ter is apt to get into small cracks, undermining the pavement and in winter time freezing and breaking up the base. Even if the street is fully drained, it may be that the inlets are so placed as to occasion considerable streams of running water directly opposite the ends of the sidewalks, causing great annoyance and perhaps disrespect as regards the engineer on the part of pedestrians. Nothing connected with the city engineer's duties is so fruitful of criticism on the part of the general public as this one point. It is true that these criticisms are often unreasonable, but nevertheless they are made, and should be guarded against as much as possible. Finally, the general appearance of the street is in large measure governed by the drainage problem; an otherwise excellent street design may be entirely ruined by improper and awkward appliances for taking care of and carrying away surface water from intersections.

The problem is varied, and no hard and fast rule can be laid down for its solution. No two street intersections are exactly similar, and especially in hilly towns, such as the one I have the honor of serving, the handling of one intersection can never be taken as a criterion for the proper disposal of the next. A catchbasin location which would be entirely right and proper on a gentle slope may be left high and dry by a stream of water rushing down a 10 per cent. grade. In general, however, street intersections may be divided into three distinct classes as regards their drainage: (1) those in which all grades lead away, or, in other words, where the intersection is on a summit and where, of course, the amount of water collecting is so small that no provision need be made for caring for it otherwise than in the proper crowning of the street surface; (2) those in which all grades lead to the intersection and where it is imperative that the storm water be taken underground; and (3), including the great majority of cases, those where part of the grades lead to the intersection and part away. In such instances it is sometimes a question whether to take the water underground at the self-draining corners or to allow it to take its natural course down the gutter. If the intersecting street is unpaved and on an ascending grade, the water should be taken care of otherwise than on the surface in order to keep trash and dirt from being washed down from the intersecting street and being deposited upon the surface of the paved street. If, however, the water flows from a street already paved in not too great a quantity, and if the grade of the gutter down which it naturally flows is heavy enough to take care of it without inconvenience or overflow, the corner can generally be allowed to drain itself. In my practice I endeavor never to allow water to flow in the gutters for more than six or seven hundred feet, as the volume of flow for a greater distance than this is, during heavy rains, enough to be annoying to pedestrians.

The remarks which follow are based upon the assumption that separate sewers are provided to take storm and sanitary drainage. With a few exceptions, however, they apply equally well to the problem in cities having the combined system, it being understood that in such cases all openings into the sewer must be securely trapped to prevent escaped of sewer gas.

A paved street should, if possible, be well drained by storm water sewers, but occasionally the engineer is called upon to pave a street where either the outlet for a proposed storm sewer is so remote as to make the cost prohibitive or for some other reason it is impracticable to sewer some portion of the street; in such cases it is necessary to provide some other expedient wherever storm water has to be carried across an intersection, and to do so is sometimes a quite perplexing problem. Several ways have been suggested, but the ideal one is yet to be found.

Valleys across an intersection designed to carry the water on the surface are unsightly, a perpetual annoyance to drivers and "carriage folk," invite deterioration of the surface, and, with swiftly moving fire apparatus or in winter time, if clogged with ice and snow, they may become very dangerous. They should be avoided whenever possible, and, if used at all (except at alley intersections where they are perfectly legitimate), they should be placed across very unimportant and lightly traveled streets only, and where they can be made with as light a depression from the normal as possible.

Culverts, with stone or concrete bottoms and walls and cast iron coverings, have been used quite extensively, but the practice should, in my opinion, be discouraged, because they are very expensive both in first cost and in maintenance, the cast iron plates being apt to break under heavy loads or sudden jars; because they are danger-

ous and afford places on which a horse is liable to slip, especially in wet or frosty weather; because they are unsightly; and because it is necessary to flatten and distort the surface of the street to meet them.

I have known of the use, in a few instances, where no better solution presented itself, of culverts with cast iron covers sunk below the finished surface of the street and carrying the regular street surface over them. Such culverts are, in my opinion, not as unsightly as if the cast iron plate were exposed, since the regular crown of the street formed of the ordinary paving material can be carried across them, nor are they more slippery than any other part of the street, but, on the other hand, they are even more expensive than the others, and they are wasteful of head room, calling for deep gutters at either end, and presenting, besides, a ragged appearance when viewed from the gutter or curb.

In many cases a cast iron pipe can be placed in the intersection with the top sunk slightly below the finished street surface, using a "Y" and a branch in cases where water reaches the intersection from two ways. This form of construction is cheaper than the culvert construction, but, as before, a deep gutter is necessary on either end, and the pipe is liable to become clogged with trash or ice and snow unless of considerable size. In my experience no pipe less than twelve inches in diameter will keep itself clean when carrying storm water even although it drains a paved street.

In several instances I have placed sections of storm sewer at the usual depth below the street surface, equipping them in the regular manner with inlets and catchbasins and running them out on a lighter grade than the intersecting street to an intersection of the flow line with the gutter surface. This is confessedly a temporary expedient, to be used only where the intention is later on to carry out the storm sewer to a proper outlet, and where the intersecting street is on a considerable grade. This form of construction is particularly useful when the street being improved skirts along the side of a hill and the intersecting streets will eventually have to be paved also. In such cases it is, I think, the best form of construction possible for the time, although it is open to the objection of affording a very ugly outlet where the sewer pipe comes to the surface in the gutter. It is best to use a section of iron pipe at the lower end, as a line of vitrified clay pipe when uncovered is very easily broken up by wagon wheels striking against it.

If the intersecting street is likely to remain unimproved for a number of years, it would perhaps be best to end up the sewer in a box covered with a cast iron grating, inclined at slight angle to the street surface, as thereby the exposed depth of the gutter can be lessened and brought more nearly to the normal. This grating should be removable, however, for convenience in cleaning, which it will require quite frequently, as it will be a very effective stop for any waste paper or trash which may find its way into the pipes.

When sewer facilities are provided, the problem resolves itself into a question of the design and proper location of the storm water catchbasins and inlets.

In regard to the design of the inlets, the principal points to be borne in mind are to provide sufficient opening to carry the water from the street surface to the sewer without unduly obstructing travel on the street, to so arrange the opening or openings that they will not be easily clogged up with trash washing down the gutters, and to avoid a pool of standing water in the basins. A great many engineers provide for settling basins by raising the outlet into the sewer some inches above the bottom of the pit, the idea being to catch trash and debris and to prevent it from entering the sewer, but, in my opinion, this is bad construction. As our street cleaning departments are usually organized, it is next to impossible to keep our catchbasins cleaned, and this pocket simply affords a trap where street washings rot and disintegrate, and where stagnant water settles and breeds mosquitoes on a wholesale plan; in other words, it is an invitation for filth and disease. It is much better, in my opinion, at least in towns where the average sewer gradient is high enough to afford easy drainage, to let everything that gathers in the gutter pass on into the sewer as quickly as may be. I sometimes regret that it is not possible to build "fool-proof" sewer systems, for not otherwise, until our street cleaning bosses see a great light, is it possible to keep our drainage systems operating at full capacity; it is indeed discouraging to plan a storm sewer and accessories according to the needs of the neighborhood, and then have it entirely neglected until it becomes so clogged that a heavy storm causes overflows onto adjacent property. The point I wish to make is that where the outlet pipe is placed at the bottom of

the basin there is not nearly the liability for unsanitary conditions, but even in such instances I have known catchbasins to fill up to the street surfact with sticks and stones within a few months after they were built. A small amount of care intelligently applied would have kept them operating nicely. What is in some respects a still better form of construction does away with the catchbasin entirely, ending the sewer branch in a 90 degree bend turned up, and building the inlet directly over this. However, if this is done, frequent manholes have to be provided to give access to the sewer for purposes of flushing or the like.

There are many designs of inlets in use—some better and some poorer; none fitted for universal use, and some not fit for use at all. A very common design is the grating fitted into the street surface. This works very well until it becomes clogged with waste paper or leaves, at which time it refuses to act at all. There are instances, however, as in alley openings, or where the gutter is placed in the center of the street, that it is the only style possible to use. Its catching capacity when clogged can be improved somewhat by depressing the surface an inch or more in the center or next to the curb.

A better form for general use, because not so apt to become clogged, is that known as the concealed inlet, located in the curb, leaving the street surface unimpaired. It is open, however, to the objection that it is generally necessary to place a manhole back of the curb to provide a way to clean it out, which is unsightly and may become a menace to public safety. Likewise, on steep grades, the water is likely to rush by it without entering even when the street surface is sloped quite severely toward it.

Our Knoxville standard combines these two styles of inlets. It consists of a grating in the street surface, depressed to the curb, in connection with an inlet in the concrete curb formed by embedding an iron plate in the concrete two or three inches above the finished street surface and carrying the curb across on top of this plate. A curb joint is provided at either side of the basin to guard against uneven settling as between the catchbasin walls and the ground beyond. The grating frame is removable, doing away with the necessity for a manhole in the sidewalk. This standard was adopted last spring and has been used this season only, so that it is yet too early to tell much as to how it will work out in the long run, but it promises well.

Where an intersecting unimproved street is on a heavy downward grade, the best and almost the only way to catch the water is by building an inlet squarely across the gutter, a short distance above the intersection, giving an unimpeded fall directly from the gutter into the basin. Such an inlet can best be covered with an iron plate.

The engineer should study closely the locations of his inlets so as to make them perform the most efficient service. Usually it is best to locate them above the cross walks so as to keep that part of the intersection used by pedestrians as dry as possible. Where, however, two descending grades meet, one frequently has a space difficult to drain lying below and between the two inlets when so located. If the grades are very light it may be possible to drain this space by showing a very small face on the curb at the center of the turn and sloping the street surface back in either or both directions, as is most convenient, to the basin. It is frequently necessary, however, to locate an inlet directly on the turn. If but a small amount of water congregates at the point, the gutter stream may not be so wide opposite the ends of the walks but that a person can easily step across. If, however, some protection for pedestrians is necessary, one of three alternatives can be resorted to. Probably the best form of construction, in this case, although calling for a higher first cost, is to locate three inlets—two above the cross walks and one on the curb turn; or, the gutter may be built with vertical sides, and the street surface made to conform. The two walls of the gutter must either be brought close enough together so that a child can step across and the gutter be left open, or else the space between may be made wider and bridged with a cast iron plate. Either form of construction affords some obstruction to street traffic, and is not to be recommended where it can be avoided, although in some cities the former arrangement may be seen at the majority of the street corners. The practice of placing a series of cast iron plates for the whole length of the curb from property line to property line makes an extremely ugly, awkward and expensive corner, and should be resorted to only in very exceptional cases.

STREET LIGHTING.

By Dr. Lewis Bell.

I need hardly say that it gives me great pleasure to meet the society at this second annual convention. But it is not for the purpose of obvious congratulations in the gathering that I arise now, but rather for the purpose, if I may put it so boldly, of bringing before you reasons for repeating the cry of Ajax for "more light."

Unfortunately, we, in these times, can only call for more light—we have not the privilege of Joshua in holding the sun and the moon still to provide it for us. Things were done in a better way in the olden times, they have always said.

The topic which I wish to bring before the convention definitely, then, is the topic of street lighting—some of the things which underlie it, some of the things which are needed to make it sound in practice as well as in theory.

Man is becoming more and more a nocturnal animal. It was not more than two hundred odd years ago, perhaps about the time that Philadelphia was founded or a little later, that the first attempts at systematic street lighting were made. One has but to consult the evidences of old books and old prints to see very plainly that our ancestors and contemporaries of the founders of Philadelphia had very little to show in the way of public lighting. A candle flickering in the wind near a window, a horn lantern casting a feeble glimmer down the street and dribbling oil on the passers-by, and a pine knot or a flambeau of asphaltum, borne by a torch-bearer hurrying through the crowd and thrusting his smoky weapon in the faces of the passers-by—these were about all that the world could boast of in the way of street lighting two hundred or two hundred and fifty years ago.

The activities of men are so far transferred from day to night at the present time that it becomes absolutely necessary to make provision for those who are traveling about after nightfall, and for the general business that is carried on at night—business of the theaters and concerts, and business of people hurrying from one place to another in the ordinary routine of their day's work extending until after sunset. For all of these purposes light, and plenty of it, is necessary, but this light we have only to a rather limited extent in most cities.

The fundamental criticism against most attempts at street lighting lies not in the illuminants used, nor in their application, so much as in an improper adjustment of the illumination to the needs of the city. Street lighting has been a growth and an evolution, but, like all growths, it has proceeded to a certain extent along the lines of least resistance.

The result is that, looking over a city—particularly an American city—however good the intention of the city government, however excellent the technical skill of those who furnish the light, much is still left to be desired. The difficulty lies in the fact that the illumination is spread out too thin, so to speak. We do not carefully discriminate between streets, the nature of the usage of which demands considerable light, and those streets which are perfectly well illumined with a less quantity of light. We attempt to follow out the general American theory that all men and all things are free and equal, and distribute a very finite amount of light over a very large area, with some approximation to uniformity, lest we hurt the feelings of our good fellow citizens by insinuating that Z street does not carry the heavy traffic and is not so crowded with by-passers in the evening as A street. In point of fact, we all know, in going through a city, that there are certain great avenues of evening traffic, certain places where light is needed all night, and every night, and a great deal of it. The commonest failure is the failure to recognize this simple fact, and in attempting a certain degree of uniformity, never exact uniformity, of course, which is quite improper when one considers the use to which the various streets are put.

There should be what there generally is not—a very careful adjustment of the resources of the city in the matter of lighting, so as to facilitate the greatest possible amount of the evening traffic. This means that in streets which are largely used during the evening illumination commensurate with their importance should be used, but for streets where the night traffic is light, and where passers-by are few, only light enough is needed to enable the people to get about comfortably. There is still a third class of street which needs individual treatment, sometimes gets it and sometimes does

not, and that is the outlying street—the merely suburban road—the country road which still comes within the province of the municipality to illuminate. In places of that sort funds are seldom available for providing anything like serious illumination, but a great deal for the convenience of the public can be done.

The purpose, the fundamental purpose of lamps in these outlying, little-used streets, which yet need some light, is merely to serve as markers of the way; in other words, in these unfrequented places, streets where illumination of the first order is unnecessary, and that of the second order needlessly great, the important thing is so to distribute the light that the illuminants serve to mark the way and clear the passage for the passers-by. In such places the somewhat common practice of using very large units of whatever kind is obviously improper. One marker a mile of 1,000 candle-power is not anywhere nearly so good as half the amount of light put out at short distances in smaller units; in other words, where a lamp is used merely as a marker to show the way, and a general illumination cannot be undertaken, the best thing is to employ small units and locate them so as to get the best results obtainable from the energy in whatever way it may be applied.

There are, then, three distinct classes of streets which must be considered in the problem of the theoretical character and practically useful illumination. First there are the chief streets—the heavy arteries of traffic which need all the light they can get. Then there are the secondary streets, making up the bulk of an ordinary city, which need to be well lighted, but do not require a blaze of illumination, because they are used in an entirely different way from the main streets. And finaliy there are the tertiary streets, in which the lighting is intended merely to show the way.

In our ordinary practice here these classes run into each other by such gradual transitions that one can hardly tell whether there was any fundamental idea in the minds of the persons who laid out the streets or not. Our chief streets, as a rule, all over the country, are really poorly lighted, the secondary streets not particularly well lighted—sometimes a little better than they should be, and sometimes not quite so well—and the tertiary streets frequently rejoice in one illuminant every long block, useless for practical purposes except within a very short radius, and utterly failing, too, in the proper marking out of the way. As regards the absolute amount of light required, there will be always difference of opinion. In the principal streets, where the traffic is constantly heavy, I think that one would not go far wrong in following the principle that one should have light enough to see to read a paper by. I would not recommend the citizens to sit out on the curb and read their evening papers, but I think the chief streets of the city should be always so well lighted that if any one must consult a note-book to find his way, or wants to refer to a letter for any purpose, he should be able to read it without having to walk a half block to get under the nearest lamp. As to the secondary streets, much less amount of light than that is desirable, and not so much is necessary, in fact. The tertiary streets can use a still less amount.

In connection with this matter it is noteworthy that the foreign practice in England and on the continent is to provide in the different streets light enough to read a paper by. This summer I traveled miles through the chief streets of the European cities, and was able to read the fine print of a Baedecker every foot of the way by the light of the streets lamps alone. That is the ordinary standard of goodness which is lived up to in the large foreign centers.

In actual amount the London canon in lighting calls for an average of something like a quarter of a foot-candle, as against one-tenth or one-twentieth in the ordinary American city. The secondary streets on the side use about the same value of illumination as the ordinary street here. The tertiary streets are still less lighted, perhaps half as much, but the light is invariably secured by comparatively small units, either gas or electric, instead of putting up very big units. So much for the general design of the illumination.

Now as to its matter. In the first place, whatever the intensity adopted, it is desirable to have a fairly uniform distribution. By that is not meant uniformity at the expense of low maxima, but it is undesirable so to scatter the lamps as to have a great deal of light here and there and none between. Secondly, it is desirable to diffuse the light so as to make it as useful as possible. One of the great points of difference between the practice here and European practice is that diffusing globes are practically in universal use except in the United States; and therefore there is less uniform lighting here than

PUBLIC LIBRARY

almost anywhere else. Merely, if for no other reason, because the light is not diffused, the illuminants themselves are of a different character, are intensely brilliant, and the result is a certain dazzling effect which very much decreases the practical usefulness of the light, on just the same principle that a bare lamp in front of one's eyes is a very inconvenient thing.

In the matter of distribution one cannot sacrifice too much for the sake of uniformity. It is a fact which one will find out readily by observation that one can light a street uniformly and yet badly. There can be a fairly good minimum on a street, and yet it may be lighted badly for the purposes of a chief street. It may be well to mention two places that I have visited. One is a place in Paris where there is a tremendous concentration of illuminants. All of the units are small and massed together, massed in a way that would show, if one deliberately sat down and figured the illumination, a result which would cause one to feel proud of it. Practically, however, the place is badly lighted. There is no effort of brilliancy; one can see fairly well all about, but the place is nevertheless insufficiently lighted.

I call to mind another place in Berlin where the average intensity is probably not very much higher—not more than 50 per cent., perhaps, where the units used are of the same kind, but of very much greater intensity. The effect is beautiful. In other words, one can dwell neither on the minimum in the street as a canon of good lighting, nor on the average as seen along the street. One must bear in mind that a big center of light, throwing an immense amount of light out into the street and being reflected from the house, adds a great deal to the efficient illumination of a street for the purpose for which street illumination is desired. One can get fairly uniform lighting, and he can take the same amount of power and get less uniform lighting which will be quite as effective. In other words, one must look at the thing as a practical matter, and not as a mere theoretical matter of so many hundredths of a foot-candle. It does not take an expert in illumination to see whether a street is badly lighted or not, and it does not- consequently, take an illuminometer, with measurements in the thousandths of foot-candles at the half-way distance between the lamps, to show that improvements are necessary. The thing is a strictly practical matter, and should be treated as such.

That brings up the question of the direction of measurement—how shall we measure the light on the street? The customary measurement in this country is a tacit apology for bad lighting. The customary method of measuring here is a measurement practically half way between the lamps with the photometer disc, or other measuring instrument, held normal to the ray. If one gauges his illumination solely by such readings as this, he can be guaranteed a badly lighted street in every case, because the tendency of competition, from whatever souce it comes, is to secure that minimum at as low a maximum as possible, modifying the illuminants to be as useless as possible, subject to the condition of getting the low minimum, and the result is a badly lighted street. I could mention types of illuminants which have been deliberately specialized for the purpose of giving two-hundredths or three-hundredths of a foot-candle, at some point down the street, whereas if the same illuminant were designed, not to give a special form of illumination, but to give the best efficiency of which it was capable, it would not only be possible to make it light the distant parts of the street, but the whole of the street; in other words, there are cases in which the efficiency is deliberately sacrificed for the sake of what is nothing more or less than bad distribution.

Every effort toward economy should be an effort directed to increase the total flux of light, because with our modern illuminants this is chiefly to be taken into consideration for street lighting.

There is no excuse to-day, whatever there may have been ten years ago, for specializing distributions by means of the design of the illuminant, because, at the present time, it must be shielded. One can both distribute and diffuse light at the same time, and, what is more important, when a street is lighted on any adequate scale all spherical distribution obtainable is needed.

The foreign practice in the matter of direction of measurement is to measure the illumination as it falls on a plane four feet above the ground, measuring on the horizontal, and thus measuring the resolved component. One-tenth of a foot-candle so measured very obviously means a great deal more than the tenth which is obtained on the normal measurement.

One is sometimes tempted to wonder on what basis this particular measurement on the horizontal was chosen and why the thing has not been more fully discussed. It has not been more fully discussed here because people do not like to talk about that little resolved component. It is so much nicer to talk about the larger normal. It is not discussed abroad with any great vigor, simply because in the first place the light is sufficient to give a thoroughly adequate measurement on the horizontal, and second, because, as a matter of fact—it happens to be a rather curious one, too—the lamps in England and on the continent are customarily placed at just about the point that makes it a matter of indifference to them which way they are photometered. That is to say, in measuring the illumination on the horizontal plane, one measures the effect from two lamps. In measuring on the normal the effect from only one is obtained. Now, at the distance and height at which big units are customarily placed abroad, whether gas or electric, only four or five times the height of the post being taken as the distance between lamps, the double projected illumination of adjacent lamps becomes substantially identical with the normal illumination of each, so that it ceases to be a vital question abroad whether one or the other method is used, the two being nearly coincident. The thing which I wish to point out is, that if the illumination on the normal is the criterion, for heaven's sake give enough of it to see something by, and not the apologetic two-hundredths or three-hundredths of a foot-candle which has been too often talked about.

This brings up the question of economy in street lighting, and in particular I want to devote a brief moment of animadversion to the so-called moonlight schedule. I think this curious minimum of a couple of hundredths of a foot-candle which has been followed too long came largely from the fact that that value was supposed to be about the maximum intensity of moonlight in this latitude. One can read by a full moon, which gives one-hundredths to two-hundredths of a foot-candle. However, moonlight is diffused, diffused with a vengeance, and from my observation I should say that moonlight, on account of its diffusion, is at least two or three times as good as an equal fraction of a foot-candle delivered from an arc lamp, or Welsbach, or large incandescent lamp, or what not, merely because in the moon light there is complete diffusion and low intrinsic brilliancy, which allows the eye to do its best work. One does not experience trouble in driving an automobile in moonlight if he has a good head-lamp; he might have trouble in driving an automobile even with a good head-lamp in a lighted street, because the lamps in the street flash straight in his face. The practical value of diffusion is recognized at once when it is called to our attention, and it should be recognized in street lighting.

The moonlight schedule, which is the favorite method of economizing, is most deceptive. In the first place, ordinary moonlight in this latitude is less than two-hundredths of a foot-candle. In the next place, the half-moon intensity, instead of being half as good as a full moon, is only about one-tenth as good. That means that there is a large element of specular reflection in moonlight, the same as from a piece of polished cardboard. Consequently the three or four days sinks to an insignificant figure; there is only one week in the month when the moonlight is of a magnitude to be of any particular account.

Customarily the moonlight schedule is perhaps two-thirds of the full all night and every night schedule, while if proper illumination is to be obtained, it should be three-fourths, or eight-tenths, or something of that order.

A second common effort at economy is through the means of half-night lighting. Half-night lighting from the standpoint of the needs of the public is a great deal better than the moonlight schedule, because, so far as the brilliantly lighted streets of the city are concerned, the legitimate activities of the city cease before morning, so that there is some reason in reducing the number of lamps after midnight or one o'clock. If anybody has to economize rigidly, it is far better to disconnect every other lamp, or something of that kind, than it is to run them on a regularly reduced moonlight schedule.

It is never desirable to go into half-night lighting or petty economies of that kind anyhow, and my purpose here is to point out particularly that the moon is a bad thing to depend upon. If the illumination must be decreased at certain times from motives of economy, it is better to do so at convenient times and systematically than to depend on moonlight and weather conditions.

As to important things of the future in street lighting. The first of them is a recognition of the fact that streets are lighted for people to use; that the streets should be lighted with reference to the use which is going to be made of them, and on the whole they should be much more brilliantly lighted than is customary in this country to-day.

ALLEY SYSTEMS FOR LARGE CITIES.*

By Wm. A. Howell, Engineer of Streets and Highways, Newark, N. J.

IN Newark, as is the case in Jersey City, Paterson, Newton and other large cities in New Jersey, there is no comprehensive system of alleys or roadways, located between main thoroughfares, to be used for the removal of ashes and garbage and the delivery of groceries and other household supplies to the family dwelling from the rear. Philadelphia, Baltimore and Chicago have such systems and have had them since those cities were originally laid out, and they have many conveniences. In the city of Newark we have alley-ways scattered all over the town, some of them of quite ancient origin, a few indeed dating back to the foundation of the city in 1666. Most of these alleys are lined with stables, automobile garages, occasionally a small factory, but many especially in the residential districts have small dwellings located thereon. A few of these alleys in the central part of the city have been paved with modern pavements, quite a number have been paved with cobble, but the greater number until the present year have remained unpaved—have been overgrown with weeds, and have been the dumping grounds for rubbish and even garbage. These alleys have given our board of health much solicitude as very possible sources of contagion.

Every few years when cholera, yellow fever or smallpox epidemics are feared throughout the country boards of health in large cities look for the first appearance of the scourge in the alleys and in the crowded tenement houses, and give immediate attention to their thorough cleansing. And yet here far removed from the bustling outside world are the humble homes or workshops of good citizens, interested in the welfare of the community at large, taxpayers as eager for public improvements as their neighbors living on more pretentious streets. During 1909 ordinances were passed by our Newark board of public works for the paving or repairing of 14 alleys, representing a mileage of 1.184 miles, at a total estimated cost of $45,703.91, which amount included the cost of inspection and advertising. Of the mileage paved, 0.728 of a mile was paved with vitrified brick on concrete and 0.456 of a mile was paved with granite on concrete. The average cost per front foot of pavement to the property owners, of alleys paved with brick, was $3.22 and on alleys paved with granite $4.35. The average width of alleys from building line to building line was 22 feet, and the average width of the roadway was 14.68 feet. We have made many goodly improvements in our city during the last 15 years, but I cannot recall any single year, where with the expenditure of such a comparatively small sum of money, we have produced more lasting results, than our work of 1909, in transforming these 14 alleys into well-paved, well-sewered and well-lighted highways. The credit of undertaking and prosecuting this alley-paving crusade of 1909 is due to the intelligent foresight of the chairman of the street committee of our board of public works, the Hon. Arthur R. Denman, and his colleagues on our board, Messrs. Eggers, Lambert, Halpin and Budd. The work was not undertaken without opposition. A number of our worthy citizens, large taxpayers, could not see the value of the work. They were entirely willing to see the city pave alleys, if the city at large footed the bills, but in their judgment to call upon the individual property to be responsible for an assessment for alley paving or repaving was entirely unjust, coming close to confiscation of property rights. It is the opinion of one of the best-informed and well-posted lawyers in Newark, a man especially well informed regarding real estate valuations in the city, that the simple act of paving an alley, immediately doubles the value of the abutting property fronting thereon. In

*A paper before the American Society of Municipal Improvements.

other words, if land fronting on the alley before paving was worth $30 per front foot, it would be worth $60 per front foot on the completion of the pavement, although the actual cost per front foot of the paving would not be more than $4.50 per foot, and might be much less than that figure. We have in Newark about ten miles of alleys paved and unpaved. The paved alleys comprise a mileage of 3.26 miles, the following materials being used:

Cobble	1.00 mile
Brick	0.85 mile
Granite	0.75 mile
Trap	0.25 mile
Asphalt	0.06 mile
Granolithic	0.10 mile
Macadam	0.25 mile
Total	3.26 miles

During 1908 the inspectors of the board of health made 1,098 visits of inspection to the alleys of the city and reported 145 violations of the health ordinances. That alleys should be paved and well paved, does not admit of any argument. That they should be paved in advance of wider and more generally used thoroughfares is the prevailing opinion of municipal officials in nearly all large cities.

In our judgment where the traffic and the alley grade will permit its use vitrified brick on concrete is the most desirable material for alley paving. That has been the result of our experience in Newark. Whenever it is possible to do so, the pavement should be laid the full width of the alley, from building line to building line, having the gutter in the middle. If it is deemed proper on account of the width of the alley to have sidewalks, of say three or four feet in width, leaving a roadway of not less than 14 feet, a miniature street with its shallow gutters and miniature crown, rather adds to the neatness and finish of the engineering effect of the work. This brings up the question, "What constitutes an alley?" Where is the dividing line between street and alley? In our city any highway under 25 feet in width, we place in the alley classification. Through the medium of the Clearing House of the Society, our secretary, at my request, sent a circular letter to the city engineers of 35 American cities, soliciting information on the subject of this paper. Replies were received from the following 18 cities: Albany, N. Y.; Boston, Mass.; Grand Rapids, Mich.; Minneapolis, Minn.; Providence, R. I.; Syracuse, N. Y.; Austin, Texas; Buffalo, N. Y.; Moline, Ill.; New Orleans, La.; Salt Lake City, Utah; Washington, D. C.; Baltimore, Md.; Cleveland, Ohio; Chicago, Ill.; Milwaukee, Wis.; New York City; San Francisco, Cal.

The preponderating opinion of the city engineers enumerated was that the advantages of alleys greatly outweighed their disadvantages. Several city engineers, notably the engineer of Cleveland, were strongly opposed to the location of alleys in residential districts, but were in favor of their location in business districts of cities.

Reports from these 18 cities showed that pretty nearly every known kind of modern pavement was used in the various places mentioned for alley paving. The favorite materials were granite, brick, asphalt and creosoted wood block.

Our local fire board is very much in favor of alleys in the Newark business district. The chief of the fire department informed me that the city was saved on three notable occasions during the past two years from large fires in the business district by the fortunate location of alleys in the rear of large buildings which had taken fire, giving the local firemen additional opportunities of fighting the flames, which would not have been the case if the space occupied by the allays had been filled with buildings. The department store of Goerkle & Co. and two large theaters in the center of the city were saved by having alleys in the rear or at the side.

Alleys located in the business districts of large cities are admirably adapted for stables and central storage depots for large department stores, for electric lighting power plants, etc. Here away from the crowded streets, goods can be loaded and unloaded, carefully, systematically and speedily, without interruption from passing traffic on the sidewalks or in the roadway. Thousands of dollars can be saved in the course of a year to a business house with storage ware rooms located on an alley. The original cost of the site of the building on the alley is also an important item to the concern. Real estate on the broad avenue, possibly only 75 or 100 feet distant, at the front of the building will doubtless be worth from three to eight times per front foot of the valuation on the narrow alley in the rear.

In locating government buildings, such as post offices and custom houses, provision is generally made in large cities by the government architects for alleys in the rear of such structures, for the reception of the incoming and the delivery of

the outgoing mails. The public would be seriously inconvenienced if this should be attempted from the fronts of government buildings. In fact, rear alleys or side alleys are practically indispensable to the successful operation of an up-to-date post office in a large American city.

The favorite practice in a number of large cities, such as Brooklyn and Newark, is to have the period of time, when receptacles containing ashes and garbage shall be allowed to remain along the curb, reduced to a minimum. At stated intervals men in the employ of a contractor collect these cans and receptacles from yards and areas, and place them on the curb, where their contents are speedily unloaded in wagons provided for the purpose. The driver of the wagon, or his assistant, then returns the empty cans and other vessels to the place whence they were taken. This system works very well in Newark and gives general satisfaction, although it took months to get it in perfect working order. Where the above mentioned system is in use, there is little or no necessity in residential districts for alleys in the rear of dwellings. But it must be remembered that there are many cities in the United States, some indeed of more than 100,000 population, where there is no municipal provision made either by contract, or by other means for the removal of garbage and ashes, each individual householder being responsible for the removal from his own premises of all refuse. It would appear in cities of this class that alleys would be of considerable value.

THE ST. LOUIS WATER WORKS RAILWAY.

By Charles Claude Casey, St. Louis, Mo.

AN interesting experiment is being tried by the water department at St. Louis in the railway line. The department is operating a railway in connection with the water department pumping stations, which happen to be located some distance apart. It is an unpretentious railroad, doing both freight and passenger business, and is probably the only railroad in the country not subject to Interstate Commerce Commission regulation and anti-pass laws. In fact it is operated exclusively on the pass system, no fares being collected, and Water Commissioner Ben C. Adkins has the distinction of being the only railroad head in the country permitted to openly furnish national, city and state legislators and other public officials with railroad passes.

All materials, supplies, machinery and other freight used by the water department, or by contractors in repair or construction work at the plants, is carried over the lines of the St. Louis Water Works Railway. The line was opened for passenger traffic by the city in 1902, though the tracks had previously been used as a railroad switch to the water works plants by the several railroads connecting with that part of the city. High charges for the transportation of water works laborers and employes, and unsatisfactory service under contract system, moved the officials to try the municipal railway project. The service, at least, has been satisfactory and there is no indication that the line will be abandoned.

The passenger line is operated by electricity and extends from Bissell's Point, about four miles south of the terminus of the regular transit lines, to Chain of Rocks, where the intake pumping stations are located. The distance is about seven miles, connecting with Baden about equidistant between the two points. Two electric cars of modern type are used on the line, capable of maintaining a regular half-hour schedule, though no effort is made to run so frequent a service.

Last year more than 112,000 tons of freight was switched on the steam division of the road, at a cost of a little less than two cents per ton mlie. Passengers numbered more than 257,000, with an average cost of a little less than four cents. Both passenger and freight business decreased materially during the past two years, due, partly, to the improvement of Columbia Bottom Road and the making of automobile and vehicle traffic along the beautiful drive more pleasant than the car ride. It is also possible that less interest was shown by sight seers in the water works park. Less freight was carried because of a reduction in the amount of contract work under way and a consequent decrease in the shipment of material.

The cost of carrying passengers is

probably high at four cents, but the cost would have been very much less had not special cars been used by officials for quick trips to and from the plants, special cars being run when an official desired to go between the regular trips. It is probable that switching charges are also much higher than they should be, were not the locomotive frequently used when it may have been profitable to wait for a greater load.

The railroad is on the map as an "Industrial Line," being rated by the Central Car Service Association. Cars are delivered to the line by the Wabash, Burlington and St. Louis Terminal Railroads from connecting switches, under the rules of the Car Service Association. Demurrage costs on cars switched to the line aggregate about $300 a year, while joint car inspection costs the department about $300 a year additional. Under the rules of the Car Service Association, the city also assumes the cost of repair to cars damaged while on the line, but this amounted last year to only about $50, or about one and one-half cents per car.

Only one locomotive is employed. It is of the saddle tank type, built in 1904 by the Baldwin Locomotive Works, after a test of two years had shown an increased efficiency of the passenger service that appeared to warrant the assumption of freight service also. The freight department also has two flat cars, used for the transfer of greenhouse materials, and other freight within the water works reservation. The cars, however, do not leave the line.

Only the two cars are used on the electric line, the entire rolling stock of the railroad being a locomotive, two flat cars and two street cars. One car is a 48-passenger modern car, purchased when the line was started, January 8, 1902, and the other is a 36-passenger car, purchased in May, 1904. The cars are often loaded beyond the seating capacity. They are equipped with electric heaters, air brakes, whistle, etc., and propelled by two fifty-horsepower motors each. One cost $5,000 and the other $4,475, but some additions have been made, raising the book investment for the two cars to $10,204.

In the first complete fiscal year after the electric line was started, 194,987 passengers, mostly employes, were carried, and the many nearly empty special cars, carrying only one or two officials, raised the average cost per passenger to nearly 5½ cents. Each succeeding year has shown an increase in passengers, except last year, and the cost has never been as high as the first year. The fiscal year ending in April, 1907, showed 301,879 passengers, with an average cost, not including interest or depreciation, of 3.3 cents. This was increased last year to 3.9 cents, but if the passenger business had been as great as for the preceding year, ending in April, 1908, the cost would have been less than two cents, for no additional cars would have been run and little would have been added to the expense with the 341,000 passengers carried in that year.

The following is a tabulation showing the number of passengers carried last year, with the trips made, by months:

Month	Persons on Trip Passes	Annual Passes	Laborers	Total	Trips	Average passengers per trip
April	6,772	447	12,681	19,900	560	35.7
May	7,027	422	13,628	21,077	518	50.3
June	9,140	424	13,931	23,495	600	39.2
July	11,045	438	13,244	25,727	560	44.1
August	16,161	377	13,700	30,238	844	35.8
September	12,924	405	14,673	28,002	610	45.9
October	8,685	406	14,270	23,361	594	39.3
November	6,115	379	12,144	18,628	500	37.3
December	6,500	280	11,040	17,820	570	31.2
January	5,568	308	9,398	14,980	492	30.5
February	5,359	223	10,512	16,388	466	35.1
March	6,856	337	11,307	18,500	524	35.3
Totals	102,152	4,446	150,528	257,126	6,838	37.6

It is rather remarkable, the average loads that are maintained! Almost the full seating capacity of the largest car, and an average of more than the normal capacity of the smaller car, was maintained for a whole year. This indicates that the average in one direction, in certain parts of the day, when the line was being used only one

way, was more than double the normal seating capacity of the cars. The trips given are one-way trips. There were only 3,429 round trips, with an average business for the round trip of 75.2 passengers. The figures are more remarkable when it is remembered that very often special cars are run with only one or two officials, returning empty for the regular trip.

From the table it will be seen that the number of trips does not depend entirely upon the number of passengers carried. Usually about nine round trips are made daily, but in summer months, when many people spend their Sundays at the Water Works Park at the northern terminus of the line, a little better mid-day and afternoon schedule is run. It will be noted that the largest numbers of passengers were carried in July, August and September, and that practically all of the variation is in trip passengers. There is more regularity in the number of employes carried, and also in the number of annual pass patrons. Any citizen may obtain a pass for the trip from Baden to the Chain by applying at the water commissioner's city hall office, or at the Baden office. These passes are good only from Baden to the Chain and return. Annual passes are issued to all persons likely to need them and considered capable of using the privilege fairly. Annual passes are good for the full length of the line and will be accepted on any car, whereas trip passes are good only at certain hours when regular employes are not being carried.

Residents of the country north of the regular transit service and in the vicinity of the water works plants, are permitted to use the line regularly to Baden, and several hundred school children, attending school in the city, also use the line without cost.

An ordinance was introduced in the municipal assembly some months after the electric line was opened, authorizing the water commissioner to collect fares to pay the expenses of operation. This ordinance failed to pass because of an opinion rendered by the city law department to the effect that if the city collected fares, the road would come under the anti-pass laws and interstate commerce regulations, and the city would be also liable for damages in case anyone using the line should be killed or injured. By the use of passes, the city specially exempts itself from liability. The road might also be required, the city counselor maintained, in the event the city should make it a commercial line, to maintain a regular schedule, and comply with many regulations that would prevent the line from being profitable, or convenient for the department.

Following is a statement of the book investment of the electric road, furnished by Arthur I. Jacobs, engineer in charge of the supply and purifying division, within which the road is operated:

Passenger rolling stock....	$ 10,204.02
Power House, building and equipment	44,355.00
Transmission and trolley circuit	48,450.00
Electric roadbed to top of rails	149,767.74
Total investment	$252,806.76

The book investment of the steam railway division is small, and consists only of about seven miles of switches and sidetracks, a locomotive and two flat cars, with a few small buildings for storage of cars, engine, etc. As a connecting link between the plants, the freight division uses the same main line as the electric road, but it is charged only with the switches. Track maintenance charges, however, are borne jointly by the two systems, excepting switch and sidetracks, which are maintained as a charge against the freight division only. The freight division is charged with $150,000 book investment, raising the total value of the road, exclusive of right of way, to about $400,000. Interest and depreciation is not figured in the operating and maintenance expenses as given below, and would about double the expenses were such a charge made.

From the following table it will be seen that the greatest item of expense is that of salaries. As is usually the case in municipal work, more men are probably maintained than are actually needed. There is an extra crew for the locomotive, and one extra crew for the passenger division. That is, three motormen and three conductors are maintained for two cars, which only run during hours that one crew would handle. Four men—locomotive engineer, fireman, switchman and switch foreman, corresponding to conductor—are employed by the freight division. An exactly similar crew, receiving the same wages, is employed at night. Besides the regular crew on the electric cars, the road employs an electrician at $125 a month and two linemen at $85, besides a lineman helper at $2.40 a day. Motormen and conductors get $60 a month. The locomotive engineer gets $3.80 a day; fire-

man, $2.20; switch foreman, $3.06, and switchman, $2.80. Two track foremen at $75 are also employed, and the wages of a goodly number of laborers are included in the items labeled repairs and track maintenance.

The following table shows the operating cost of the freight and passenger division, not including interest or depreciation:

Items of Expense	Freight Dept.	Passenger Dept.	Total
Crew, salaries	$ 3,918.38	$4,702.60	$ 8,620.98
Repairs, rolling stock	134.96	1,036.79	1,171.75
Locomotive maintenance	237.26	.....	237.26
Coal	618.40	.....	618.40
Oil, waste, etc.	47.03	11.76	58.79
Track maintenance	6,063.28	2,145.44	8,208.72
Car inspection	424.88	.....	424.88
Car repair	16.49	.....	16.49
Locomotive shed repairs	7.05	.....	7.05
Repairs to cinder car	53.51	.....	53.51
Demurrage	40.00	.....	40.00
Repairs to scales	71.37	.....	71.37
Miscellaneous supplies	4.87	40.28	45.15
Power, electric	.....	1,943.86	1,943.86
Repairs to line	.....	1,229.31	1,229.31
Line at brick yard	.....	12.19	12.19
Repairs at railway station	.....	69.13	69.13
Totals	$11,637.48	$9,962.05	$21,599.53

Because of less construction work at the water works plants, the amount of switching for last year, as shown by the table, is less than for either of the three preceding years. For the year ending in April, 1908, for instance, 167,529 tons, or 3,884 car loads, was switched at a cost of $5.08 per car. The ton mileage was 927,229 and the cost per ton mile averaged 2.12 cents.

Freight carried last year aggregated 112,031 tons, in 2,742 cars and 588,758 ton miles. The average cost of switching per ton mile was 1.977 cents, and the average per car was $4.24. The cost of switching coal, of which the following table shows 48,240 tons, averaged 8.2 cents per ton. The following table shows the business done by the freight department:

Kind of Freight	Cars	Tonnage	Tons Freight
Coal	879	48,240	199,428
Lime	440	12,072	96,084
Iron	181	5,171	36,182
Rock	664	28,183	163,801
Sand	128	6,228	33,896
Cinders	127	3,138	10,701
ravel	96	3,998	24,644
Brick	63	1,994	8,350
Lumber	21	359	1,371
Steel	20	380	2,910
Cement	19	749	4,400
Ties	15	410	2,110
Pipe	14	237	1,006
Machinery	13	177	1,273
Scrap iron	10	126	63
Miscellaneous	52	571	2,759
Total freight	2,742	112,031	588,758

The operating cost of the road for last year was reduced so greatly that the decrease in freight handled did not show a higher average cost, but, on the contrary, showed a decrease per ton mile of .143 cents.

The financial end of the proposition is not as encouraging as that of convenience, for there is not a dollar of receipts to balance against the $21,600 of expenses. Convenience and a possible saving in the aggregate cost of running the water department, however, were the only considerations in the starting of the railroad, and considered from that point of view the road may be successful financially. There are no figures, though, to substantiate any claim of less operation costs of the department as a whole, because of the railway.

In justice to the line and its management, however, it seems only fair to explain the condition of the transportation problem now, as compared with the former arrangement. When the electric line was started in January, 1902, the department had a contract with the Burlington railroad to transport employes from Baden to the Chain of Rocks works for $5,000 a year. Baden, as has been explained

before, is four miles north of the southern terminus of the electric line, and but three miles from the Chain. Before the city line was started employes were only carried from the end of the private transit lines, or from Baden to the Chain, but employes are now carried, when convenient to them, from the Bissell's point station, four miles further. Under the contract only employes were carried, and in addition to carrying a larger number of employes, nearly as many citizens are now carried free of cost. Another convenience to be considered is the number of trips made, which, under contract, was but four a day. This has now been increased to nine and ten a day, round trips from Bissell's point to the Chain, not including special cars frequently run from the Bissell's point or Baden offices to the Chain and return to carry parties or one or two officials. The cost is about 40 per cent. greater, but seems to be worth it.

It was stated that there were no receipts to balance the operating cost, but the statement was made without consideration of the electric light and power service that is being furnished. The power plant and transmission line are included in the electric railway book investment given, and the cost of operating the electric railway includes, to some extent, the cost of furnishing the electric current used for the remainder of the system. It is not necessary to assume, however, that because the light and power plant for the whole water works system is figured as an investment on the railway books, that the railway is necessary to the successful operation of the light plant. This is not the case, and the department could easily have made its current without establishing a railway. If the railway were credited with the saving resulting from the starting of the light and power plant, the receipts represented by the difference in the present cost as compared with the former contract cost would have paid for the railway maintenance and operation. If the city were now paying the contract price it was paying before the several municipal plants were installed, the cost of current for the water department would be approximately four times what it now is. With the installation of two or three municipal plants in public buildings, which now furnish light and power current to nearly all of the important city buildings, the contract price dropped. At the reduced price, the water department was paying $11,000 a year for half as much current as it now uses, and the double quantity of current is now costing only about $8,000, or something near 28 per cent. less. Not only is the department getting its current at less than two cents per kilowatt hour, but the establishment of the power plant, and that of the five other municipal plants, has fought down the price of current which the city still has to buy to 4½ cents, against 13 cents formerly paid. Small consumers are still paying 12 cents, which is an indication of what the city would be getting were it not able to defend itself. These are really considerations aside from the railway. The instance is cited to show the condition which led up to the railway, and not as an effort to show the railway itself to be a financial success.

It is hard to estimate the financial status of the freight line. It is operated as an entirely separate proposition, operating and maintenance expenses being kept separate. There are no figures to show the change in cost. Most of the switching was done as a part of the original freight charge, and it will be seen that it would hardly be possible now to separate the former cost and compare it with the present. It is also mostly a matter of convenience, otherwise the line likely would be abandoned. The locomotive is always ready, day or night, to furnish transportation power for moving machinery, setting cars, or any switching work that may be required, thus avoiding the necessity of calling for expensive service from the Terminal railroad. The line is really outside the city and beyond the regular city terminal service, though the city limits are extended north three miles along the river to take in the line and water works plant. Officials also estimate that contractors taking work at the water works plants, knowing that they have the switching facilities of the city line at their disposal without cost, bid much less for construction and reconstruction work, thus giving an invisible saving that may tend to make the line profitable, for there is much work to do, and contracts result in much switching, in a $30,000,000 water works system.

BITUMINOUS PAVING CEMENTS.*

By L. Kirschbraun, Asphalt Chemist of Chicago, Ill.

RECENT years have seen a great advance in the technology of the asphalt paving industry. Competition and the monopoly previously held by the Trinidad asphalt have forced the development of other sources of supply. The first successful paving bitumen so developed gave impetus to scientific developments in this industry and opened a field of endeavor to engineers and chemists which, in spite of the tremendous advances of the last ten years, must still be in the early stages of evolution.

The necessity for knowledge and the pressure for ever-increasing competition brought workers into the field from two directions. From one side chemists and laboratory experts who patiently devised tests and separations to fit personal theories founded upon their own laboratory results. On the other side were the practical workers in the field, the much maligned rule-of-thumb men, who manipulated their materials as best they knew—who often produced surprisingly good results, and as often poor ones. This occurred because they failed to grasp the principles underlying their manipulations and because of the lack of practical methods of controlling the conditions entering into their work. It was only when the chemist included the paving plant with his laboratory and learned to develop the means of control which were of practical value that the co-operation necessary for such development could be effected.

The advance has since been rapid, both in the direction of a more extended laboratory knowledge of the properties of bitumens and also from the viewpoint of practical results. Various principles underlying the manipulation and preparation of paving mixtures are being developed and recognized from the close laboratory and field observation of resulting successes and failures in practice. Laboratory methods and tests based upon such observations and not upon theories have pointed out the wide practical application of these principles and have opened up a fertile field in the combining of various solid bitumens, in the selection of the proper fluxing materials, and finally in the proportioning of the various elements entering into the paving mixture. All of this has made possible the utilization of bitumens formerly not considered capable of producing good pavements. In fact, the testing of bitumens bids fair to become not so much a matter of differentiating the good from the bad, but more properly a means of determining just what method of manipulation and handling is required for the successful use of the materials examined. In a practical way, it is quite possible now to determine from properly prepared data of chemical and more especially of physical properties, the lines along which an untried paving cement should be manipulated to produce such successful results.

The proper manipulation of a paving bitumen is becoming recognized more and more as the determining factor in its success. No chemist is justified in giving an opinion of an asphalt without consideration of the method of its handling. Few asphalts can be successfully treated each in the same manner as all the others, and the tendency of most operators towards manipulating untried asphalts in the same way as they would handle Trinidad or Bermudez has resulted in many failures which have been unjustly attributed to some inferiority of the asphalt itself. Consider, for example, the use of Gilsonite, which today, when handled properly, gives excellent results. The first users of this bitumen combined it with a paraffine flux. Its use in this way and along the lines of Trinidad was, to say the least, unsatisfactory. Later, with the development of the asphaltic base oils, its use was resumed, but not with complete success until it was discovered that the paving cement with such flux must be prepared of much different consistency, and that more of it was required than in preparing a mixture in which Trinidad asphalt was used as the cementing material. The Gilsonite was at no time at fault; its success was entirely a matter of manipulation. Consider further the situation had Gilsonite been the first successful material in use. The later use of Trinidad or Bemudez asphalts, handled along the same lines as Gilsonite, would have done much toward discrediting the early recognition of the value of these materials. The development of the standard paving mixture, both as to sand grading

*A paper before the American Society of Municipal Improvements.

and as to the proportion of bitumen, gave expression to an immensely important principle, yet its application is particularly effective to those bitumens in use at the time of its development, and in general to bitumens of similar properties. Its application as a hard and fast formula to all paving bitumens, irrespective of their nature, would result in error, and as a matter of fact the strict procedure along these lines has produced many imperfect results with certain asphalts which differ widely from Trinidad in those physical properties which do not favor this form of mixture.

The testing of bitumens has properly followed along the lines of comparison with successful materials taken as a standard. However, exaggerated value and improper interpretation have been placed upon many of these tests. For example, ductility tests, although having their proper significance and value, mean little or nothing when considered in terms of ductility itself. A California asphalt having several times the ductility of Trinidad is not thereby a superior material. Testing along these lines has often led to eroneous conclusions, as variations from results obtained upon the standard material have not been properly interpreted, but more often considered as indicative of inferiority. Results in actual practice have often seemed to confirm these conclusions, when, as a matter of fact, these results might more justly have been ascribed to the manipulation of the material in question along the lines of the standard rather than in the way to which such material was individually adapted. The necessity for a wider interpretation and extension of laboratory data, with a view to adapting the manipulation to meet these variations in physical properties, is evident.

It has been the experience of the writer to note in several instances that certain asphalts or combinations of bitumens, condemned as unfit for paving by chemists basing their conclusions upon comparative data, have, in actual practice, given successful results. This has been accomplished often accidentally, sometimes through the intelligent manipulation of the material in accord with its particular needs. Study of such results, together with the development of laboratory methods capable of discerning the significance of certain physical properties, has made it possible to recognize the underlying principles governing the manipulation of previously unsuccessful asphalts and combinations of bitumens. The application of these principles is so broad as to point out the possibility, that given certain basic conditions as to cementing value and chemical stability, almost any asphalt can be so modified or manipulated as to produce a satisfactory pavement.

The writer does not wish to advocate the unrestricted use of all of the various paving materials now upon the market. Nor should the unlicensed experimenting which would result from such a condition be encouraged. Few contractors are capable of working out the proper manipulation of an untried bitumen possessing different properties from the ones to which they are accustomed. Under such conditions, specifications entirely open in character would invite disaster to a municipality. On the other hand, where intelligent inspection, both laboratory and plant, is maintained by a city, a widening of the range of admissible materials becomes advisable to the extent that the inspection system fulfills its purpose, and in the degree that the contractors become educated to scientific methods and to the principles involved in these manipulations.

MEMPHIS UNDER A CITY COMMISSION.

THE city of Memphis, Tennessee, was perhaps the first city in this country to have a form of government approximating the modern "Commission Form." It was imposed upon the city as a matter of necessity and without reference to the principles upon which it should have been based, and consequently has been more or less unsuccessful up to the present date.

The last legislature modified the form to conform more nearly with that now known by the name, and the new administration takes its place on the first of January, 1910.

During its early history, beginning December 9, 1826, the city passed through the stages of town and city government, election of mayor from the board of aldermen and by popular vote, martial law in 1864-5, one and later two legislative bodies, until the yellow fever epidemics of 1873 and 1878 depleted the population and, by

the consequent increase in indebtedness and diminution in taxable values reduced the city to bankruptcy.

As a method of gaining time and authority to settle with its creditors, the city surrendered its charter and the state legislature formed the taxing district of Shelby county and established as the governing agencies a board of fire and police commissioners and a board of public works, which, together with a board of health formed the legislative council. There was also a school organization, a water commission and later a park commission was established, all of which were independent of the other activities of the city. Taxes were imposed by the legislature directly, and the old city debt and new bonds of the taxing district were governed by the legislature. Later amendments were made which restored the name of the city and the power to levy taxes, but the issue of bonds could only be made by direct authority of a legislative act, and for the last four years the city's administrative bodies have been a board of fire and police commissioners of five and a board of public works of ten, which were of equal law making power, and together formed the legislative council.

This organization now gives way to a commission of five, including the mayor, the members of which, when the terms of office of the holdovers have been equalized, will be elected every four years.

While the double commission emphasized the irresponsibility of individuals, the history of the city under it gives some exaggerated idea of what may be possible, with the best of intentions, under a commission form of government when the fitness of the individuals for the offices they will fill on the commission is so thoroughly a matter of chance as it is in most of the variations of the plan which are now in operation or are just coming into action.

The city of Memphis is growing very rapidly, particularly in business and in importance in the district of which it is the natural center, and is becoming exceedingly restive under the restrictions of law and of inadequacy of methods of handling its business and making its improvements. This is shown in various ways: By the free hand given the park commission under special laws, by the efforts to broaden the power of the city government in inaugurating public improvements, by the efforts of the public spirited organizations of business men to find out what is the trouble with the municipal government and what can be done to set it right.

The former movements will be considered in later articles. The last resulted in the establishment at least temporarily of the Bureau of Municipal Research, which is based on the same principles as the corresponding organization in New York city, which supplied a trained expert to carry on the detail of the Memphis work.

This bureau has recently published its first report, which discusses the defects in the plan of government of the city and illustrates them by descriptions of methods of doing business in one of the departments under the board of public works. The report again demonstrates the fact that elected officials of a city are seldom experts in the duties pertaining to their departments, and that when the demands of politics are met by these officers the quality of subordinates selected is not always of the highest, the restrictions upon those who are competent are too severe to permit the best service, and the unwillingness of the incumbents of the various offices to aid other officers or permit interference with or addition to their own duties all cause the methods of doing business to fall into certain ruts, which may or may not follow the law, but are in the lines of least resistance.

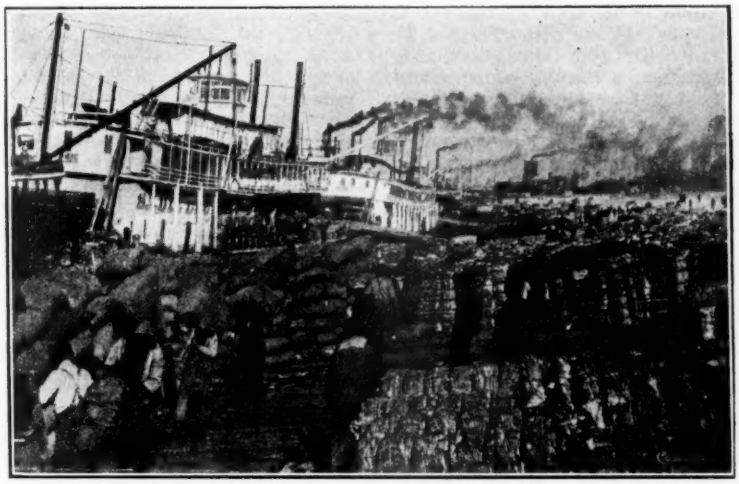
An example from the report will show what happens without any particular influence to give direction to the course of procedure. It is not hard to imagine what might occur if some one gave a conscious direction which would give him an opportunity to take dishonest advantage of the lack of system.

Requisitions are made without check as to whether they may overdraw the appropriation upon which they are drawn. Orders are often given verbally and invoices may reach the department long after the materials have been used beyond hope of checking the voucher, there being no regular record of receipt of goods. When the invoice, written or verbal, is approved verbally or in writing, a voucher is prepared, approved by the head of the department after verification of extensions and additions, accepted by city paymaster, signed by city register, who prepares warrant which is signed by mayor and two fire and police commissioners and the city tax receiver, delivered to the payee and receipted for by him and once a year all vouchers are audited by expert accountants appointed by the legislative council.

That this procedure is ineffective is

shown by numerous instances in the report. Thus in one voucher for $3,383.54, an item of $25.80 was entered as $258.06; another of $4.72 was entered as $47.25; and another of $7.42 was entered as $74.25, making a total difference in favor of the payee of $341.62. These errors were in the original invoice, and notwithstanding the numerous signatures attesting the correctness of the voucher were not detected until the investigation by the Bureau of Municipal Research discovered them.

Accounts were overdrawn, vouchers were assigned to wrong appropriations and other errors occurred, showing utter lack of co-operation of officers and of efficient check upon their operations.



MEMPHIS LEVEE IN THE COTTON SEASON.

The same lack of business methods is shown everywhere, being even more pronounced farther up. Thus the budget is fixed with no reference to the actual needs or the relative needs of departments and appropriations are made with the expectation that the law will be violated by overdrawing them. The fact that the same authority which spends the money also makes the appropriations makes it easy to transfer funds and manipulate them to keep within the letter of the law.

Numerous similar difficulties are shown in the report. There will be no change in the theory of the government of the city. The changes are only in form, and four of the present legislative council (possibly five) will be on the new commission of five, so that there is no change in personnel aside from the dropping of ten men and a rearrangement and reassignment of duties to the five remaining. The commission is still both the legislative and the administrative body.

The mayor, in addition to the general supervision of all the affairs of the municipality, assumes direct charge of the offices of city attorney, city judge, city clerk, health department, city paymaster; certainly enough for one man.

The fire and police departments are under one commissioner instead of five.

The department of streets, bridges and sewers is under one commissioner instead of a board of ten.

The new department of accounts, finance and revenue will take up the accounting for all departments and include the inspector of weights and measures and the collector of license and privilege taxes. This department is the one which can do the most in bringing the business of the city into systematic operation. If it will begin at the beginning with expert operators and will bring order out of the existing muddle (which will become for a short time a chaos under the new administration), and will do this without granting favors to any one or to any department, it will do much to prove the value of the commission form and will give the city government a standing which will carry it through many errors in other directions.

The department of public utilities, grounds and buildings will have charge of railroads, street car lines, lighting, telephone and telegraph companies, the water department, wharfmaster, mar-

ket house, and inspectors of buildings, gas, electric light, boiler and electric installations, public grounds, buildings and parks, provided that it shall not interfere with the park and water commissions. This class of problems will also be much the better for being in charge of a special commissioner.

One valuable feature of the new law is the establishment of a civil service commission appointed by the city commissioners which tests the qualifications of persons for employment in the various departments.

Bonds may be issued by the city commissioners, but the voters may on petition have an opportunity to decide whether they shall be issued or not.

The school, park and library taxes are fixed by the law and must be levied by the city commissioners and paid over to those departments for their independent use. These departments are also granted by the legislature independent powers of issuing bonds within limits fixed by the legislature in each such act.

The act is brief and continues in force the existing charter provisions not conflicting with it.

The new mayor was one of the holdover commissioners, so that the first act of the new commission will be the filling of the vacancy. The one officer was voted for at the election in November, and party lines were almost wholly ignored, although there was some indication of considerable factional strife. The great interest in the new form of government was shown by the large poll, and the business man, with some experience in the council, was chosen, his principal opponent being a man more generally known as a politician who gave excellent satisfaction as mayor in former years.

Memphis is bursting the bonds of its youth and preparing for the large growth which is ahead, and its career under the new form of government will be watched with great interest. Later articles will show the excellent work done by park and water commissions under the freedom which is theirs and the difficulties which have attended the development of sewer systems and street paving under the serious legal handicaps of the past. These are now in process of removal, and further changes in the laws permitting greater freedom of action will doubtless be made if the city commission shows that it is worthy of being granted the larger powers.

MUNICIPAL OWNERSHIP IN EDMONTON.*

By A. Maclean, Superintendent of Water Works, Edmonton, Alberta.

THE following outline of a series municipal enterprises conducted in the city of Edmonton may be of interest to most of the members of the American Waterworks Association. Few of the delegates attending the convention can be much in touch with the principle of municipal ownership and management. The general absence of belief in the adoption of the principle is evidenced by the fact that only a few city councils on the North American continent have had the temerity to indulge in such experiments, and the writer, in placing before the convention this snmmary of Edmonton's doings, is actuated by the desire to make known to his fellows engaged in civic utilities, some facts seldom met with on this continent. In no way is the paper intended to convey the idea that all cities can operate their own utilities successfully. The great essential of the success of all enterprise—good management—may or may not be present in the attempt of a city to own and operate its own utilities. Where it exists, success will result; where it is absent, failure is sure; and the presence of good management should alone dictate the extent to which the principle should be adopted.

It is generally conceded by all authorities on the development of municipal ownership that the city which starts on the path of collective enterprise usually begins with water. The municipal control and operation of waterworks is the first logical step in a city's growth toward municipal ownership. The fact that water is the first utility which a city seeks to own is due to a number of obvious causes, the foremost of which is the relation of a pure and plenteous water supply with public health and fire protection. It might be unsafe to contend that all cities (or the majority of cities) on

*A paper before the American Water Works Association.

this continent own their own water supply, but it is generally the case that cities seek to own that utility before owning others. As a waterworks superintendent I have always believed that the public health and security from fire enjoyed by a community is measured by their ownership of the water supply and the intelligent interest which the community takes in that ownership and operation.

In the city of Edmonton, however, where the writer is at present situated, the council has gone far beyond the initial step of taking over the water supply. Early in its history the city fathers conceived the idea that anything of the nature of a monopoly could be best administered by the city. The sphere of activity in a city which is usually occupied by the telephone company, the street railway company, the electric light and power company or companies has in this city been occupied as a legitimate ground to expand the functions of municipal government. The conservative-minded observer, who believes that private control alone can successfully manage large undertakings, may look with grave misgiving at such a gigantic undertaking in collective enterprise, yet the experience of the city of Edmonton is that the adoption of the principle has been phenomenally successful.

The writer during that portion of his life as a municipal servant in the city of Vancouver had little belief in the success of a municipality to undertake the operation of street railways, telephones, etc. On arrival in this city, however, he was faced with a new set of conditions. Obstacles which he believed existed to make municipal ownership an experiment of some risk he has seen overcome easily. Benefits which he believed could be best realized by a municipality whose enterprises were in the hands of corporate interests he has seen were the lot of the citizens of Edmonton to a degree and in a measure never before met with in his experience in other cities. Naturally, he has been forced to revise his ideas regarding municipal ownership; he has had to reform his conclusions in the light of an array of evidence hitherto not in his possession. If it were not for the length to which a discussion of the principles underlying successful municipal management might be carried, and the inability of the writer to do such an important subject justice, it would be his endeavor to deal with the entire subject. Failing such a discussion, however, he would like to summarize some of the benefits of the adoption of the principle in Edmonton, and emphasize what appear to him to be the greatest factors of its success.

The city government here consists of a mayor and council, elected by the people; a board of three commissioners, one of whom, the chairman, is the mayor. The commissioners are appointed by the council, one being known as finance commissioner and the other as public works commissioner. In mentioning the composition of Edmonton's civic government, it is the writer's opinion that the form of government has no direct relation to the success or non-success of the principle of municipal ownership. Given a community of average intelligence, possessed of a normally live interest in its own affairs—a community holding its elected aldermen responsible for the success of its administration—it matters little whether the commissioner system or the committee system be the method of administering the business. Responsibility for the success of the city's enterprise is of far more moment; and the community which retains the services of its best aldermen and sees that their administration is always at the high-water mark of efficiency, will secure results independent of what form the government of the city takes.

In the matter of its selection of councillors, the city of Edmonton has been singularly fortunate. Men of sound business experience have willingly given their services, and the record of the past five or six years of municipal enterprise has produced results which are a credit to all concerned.

It may seem strange to many that such a statement should be made, but the writer is convinced that the councils of the city of Edmonton have carried through work, embarked on projects, financed undertakings, with a degree of success impossible to private enterprise. All this has been accomplished, too, without any monetary interest accruing to the directors, who, sitting in their capacity as aldermen, have worked more efficiently than the directorate of a trust, with the largest possible dividends in sight, would have done. In this connection, he would like to mention a few striking differences between private enterprise and municipal enterprise.

The first difference most noticeable is the ease with which a city with an assured future can borrow money in the world's markets. When the markets of the world are closed to the best class

of security held by corporate interests, the well-governed city can obtain money for its undertakings with ease. It can at all times secure more and cheaper money for its ventures than private enterprise can secure for the same kind of ventures. And this is one of the first and greatest advantages which municipal ownership and operation has over private ownership. It may be that the people of Edmonton have a different viewpoint from that of the people of other cities. The writer knows they possess a viewpoint which was not his before he lived here, but it cannot be denied that the determination which they have evinced to control their own franchises has resulted in a success creditable to their council and themselves.

Another difference between municipal and private enterprise is the fact that the citizen who uses the city's water is aware that its rates coincide exactly to the cost of production of water. If his rates are high, then he seeks to discover the cause, and the result is usually that he does discover it, and the inefficiency or lack of economy is remedied. So it is throughout the whole field of municipal management. The fares of the street railway cheapen in proportion to its success. The rates of the electric light, power and telephone are reduced as the increase in the number of users of these utilities makes economy possible. This is not a mere theoretical statement of the effects of municipal ownership; *it is the actual experience of the citizens of Edmonton.* Some may imagine from this that an ideal condition of life must exist in our Albertan capital, so the writer hastens to assure them that we are not yet a Utopia, but bear all the evidence of being one in the making.

The writer now comes to what he believes to be the greatest controlling factor in the success of municipal management in Edmonton—the fact that the heads of departments have been given complete control of their respective spheres, with a tacit understanding that they have been placed there to make good or get out. Not merely is the mechanical operation of each department completely under the control of the superintendent, but he also is responsible for all the financial details involved in its operation, both of revenue and expenditure. This entirely precludes the interference from which expert city officials sometimes suffer, and leaves each superintendent to pursue the even tenor of his way in peace. The value of such a course, viewed from the point of efficiency, cannot be overestimated. It is hardly to be wondered at that Edmonton should forge ahead on its progressive course, and that with a street railway system which would do credit to a city twice its size and fifty times its age; a telephone system of the latest Strowger automatic electric type; a power and light system growing fast, but scarcely fast enough to accommodate users on account of its exceedingly low rates; an extensive waterworks system gradually being evolved and expanded to meet the demands made upon it by its growing population; Alberta's capital should lead the way to a condition of municipal life in which all the cities of North America should control their own franchises and utilities and dispense with all the scandal and suspicion of graft which connects itself with their sale.

EDITORIAL COMMENT

Depreciation and Sinking Funds.

Care of Street Trees.

Woods for Block Pavements.

DEPRECIATION AND SINKING FUNDS.

The modern and more accurate methods of accounting which are being introduced in all sorts of corporations, and most noticeably in public service industries under both public and private ownership, require that attention be paid to some items belonging to the cost of production which have heretofore been neglected to a greater or less extent. It has been too generally the custom, in manufacturing plants particularly, to assume that the net profits of the year are the apparent net profits, and to declare dividends from them. This plan works where depreciation of plant is slow for a number of years, but the day of reckoning comes, when renewals of plant must be made and the money to make them has been distributed in dividends. The increase in expenses on account of the reduction in efficiency of plant comes at the same time. The result is stoppage of dividends, if the profits are large enough to make up the deficiencies, issuing of new capital by sale of bonds or stocks, or bankruptcy and reorganization. The losses by the latter step are therefore often more imaginary than real, the reduction of dividends or scaling down of investment in the times of trouble being merely the forced return of the prior dividends which should not have been declared, but which should have been held for the reconstruction which is inevitable. Much of the watering of stock which is done has as its excuse the large dividends which are possible so long as depreciation and repayment of borrowed money are neglected, so that large showing of profits can be made.

The lack of provision for repayment of bonds mentioned in the last sentence is quite as reprehensible as the neglect of depreciation. The two are of similar nature and have similar effects. Indeed, they may almost be considered the same.

There has been much discussion of the subjects of depreciation and sinking funds, and there is much misapprehension and misunderstanding regarding them, even among expert accountants, and the results of this misapprehension and misunderstanding are shown in the considerable differences in the terms of court decisions upon cases involving them. Experts are far from agreement upon their treatment, and the following is offered as a contribution to the discussion in the hope that it will throw a little light upon some of the dark places.

Perhaps the clearest illustration of the principles can be given by making some assumptions which in themselves are practically impossible, thus separating into parts the complications of the actual cases.

Let us assume that a plant is built with money raised from the sale of stock, and that it is operated at an annual net profit sufficient to meet all legitimate demands. These demands apparently are that the annual dividends shall be equal to the market rates for money, and that the investment shall be as safe and as profitable at any time as it is at any other. A very simple instance would be a water plant supplying a constant number of consumers with a constant supply at a constant price. The cost of operating this plant will not be constant. The amount of useful work done by it will be constant, but depreciation in the machinery will increase the cost of operation, depreciation in the distribution will increase the leakage and consequently increase the pumpage, depreciation in boilers and pumps will increase the amount of coal consumed, etc. This depreciation ultimately requires the renewal of the entire plant,

not all at once, because no two parts of the plant wear out at the same rate, but ultimately every part must be replaced.

There are two ways in which this replacement and increase in cost of operation, both due to depreciation, can be taken care of. One is to charge it to cost of operation, the other is to provide a fund out of the net profits with which to make the replacements. Some accountants contend that both these classes of charges must be charged to operating expenses, so that the plant will always be kept up to the condition when it was new. This contention is undoubtedly correct if the capital stock represents all the cash put into the plant. The only difficulty is that the charges vary from year to year with a marked tendency to increase, except perhaps for a few years after each thorough overhauling, for the year of which the charges for depreciation would be excessive. If, therefore, the assumed conditions of maintenance of value of investment are to be met, there must be some sum set aside each year which will in the long run equal the expenditures due to depreciation, but will, under the conditions of uniform income, be the same amount each year. This account must have some name, and, since the whole of it is due to depreciation, it may well be termed the depreciation account, and it may be credited each year with the amounts expended during that year to maintain the condition of the plant and meet the increase in cost of operation which cannot all be eliminated every year by the highest possible standard of maintenance.

A second assumption may be made which is the same as the first except that the entire cost of the plant is met by the sale of bonds, in which case, to prevent complication, the stock should represent only the control of the corporation and should receive no dividends. The cycle of the corporation is completed without loss or gain, aside from the service rendered and the interest on the bonds, if the bonds are all redeemed when the plant is all worn out. Theoretically, therefore, there should be money enough on hand when the bonds are due to pay them, and, if the plant were like the "one-hoss shay," it should go out of existence at the same time. That is to say, the period which the bonds are to run should be the theoretical life of the plant, and there should be set aside each year a sum which, with the interest thereon, will equal the bonded indebtedness when it is due. The operating expenses will be charged each year, therefore, with the interest on the bonded indebtedness and a uniform payment toward the sinking fund. They will increase each year by reason of the depreciation, as above explained, unless some balancing is done.

Under the first assumption the plant is kept up to the original condition all the time and the investment will still be intact at the end of any period. Under the second assumption the investment will be returned at the end of the period and the plant will be worn out.

A company operating strictly according to economic laws under a perpetual charter would follow closely the process of the first assumption. A company operating under a limited charter providing that the plant should be turned over to the city at the end of the franchise would approximate the procedure under the latter assumption, the principal difference being that the rates charged consumers would be large enough to pay the value of the plant as turned over to the city in addition to the charges necessary to be met under the said second assumption. The value of the plant at that time would be the remainder after deducting the depreciation for the franchise period from the original value of the plant, plus whatever had been spent on it to replace depreciation and keep the plant in condition for economical operation.

Under the first assumption it is necessary to fix a schedule of lengths of life of the various parts of the plant, estimate the increases in operating expense and determine a uniform amount to set aside annually for the depreciation fund from which to draw for replacements and renewals. In any actual case judgment must be exercised

at all times as to what should be charged to this fund and what should be treated as new construction and therefore paid for out of new capital.

In the second case the average life of all the parts of the plant must be assumed as the period of the bond issue; a sum should be computed for increase in operating expenses or its equivalent, replacements to prevent the increase in operating expense; and the capitalization of this sum plus the cost of the plant will be the amount of the bond issue. If the bonds all run for the whole period, the sinking fund payment each year with the obtainable rate of interest will be fixed and is the annual charge against operating expenses.

So far as the charges against operating expenses are concerned, the two cases are equivalent. In one case the charge goes to a depreciation fund, in the other case to a sinking fund.

Some accountants contend that both allowances must be made, but this separation of the two cases for purposes of demonstration apparently teaches that either one is sufficient to complete the round, and that if both charges are made we have at the end of the bond period not only a repayment of all the original cost of the plant, but also the plant in a condition equal to its original. The stockholders, therefore, who under the second assumption put no money into the concern, have come out with the entire plant in its original condition. The consumers have paid for this plant in addition to their legitimate payments for service and interest and one repayment of cost of plant. They have paid this sum over and above the proper charge. Doubtless this doubling of charge, whether consciously or unconsciously made, accounts for a large amount of the water in the capitalization of public service corporations and others as well. The provision for the double charge in the rates and then the neglect of the charge in declaring of dividends accounts for much more water, and for high dividend rates followed by receivers and reorganizations when the time for bond paying or rebuilding of plant arrives.

Payment of depreciation from year to year, even when equalized, results in higher rate than payments to a sinking fund which draws compound interest, but it results in better condition of plant and more economical operation.

In any actual case the procedure must be a combination of these two processes, because part of the money invested in the plant is derived from the sale of stock and part from the sale of bonds, but it is certain that this combination must not be the sum of the two, but such a distribution of them that the plant will be kept in good working condition and the bonds repaid at maturity, but the value of the plant added by the payment for the bonds shall not accrue to the holders of the stock unless they shall have made the additional investment, either by putting in new capital or by foregoing their dividends for the benefit of the sinking fund.

If convenient, both depreciation and sinking fund accounts may be kept, but the sum of the two should never make a charge against the annual receipts greater than the average depreciation charge under the first assumption made.

CARE OF STREET TREES.

The interest in street trees is growing rapidly. The earliest statutory provision, aside from brief provisions in a few city charters, was the New Jersey law under which East Orange has been operating for a few years with the success which has been reported from time to time in MUNICIPAL ENGINEERING. Pennsylvania followed with a similar law, which is slowly gaining recognition from the cities of the state.

One of the most recent movements in the interest of street trees is one begun by the Chicago Womans Club a year ago, which resulted in an ordinance authorizing the Special Park Commission, which has jurisdiction for certain purposes over the city generally, to appoint a city forester to take charge of the street trees and to advise property owners regarding the care of their trees.

The apportionment for the first year being limited to the salary of the forester, little beyond advisory work has been possible. The activity of the new officer is suggested by the series of bulletins and pamphlets which he is issuing. These publications will be of value to others and can probably be obtained on application to J. H. Prost, the city forester, at 501, 200 Randolph street, Chicago.

One bulletin is devoted to the tussock moth, which is illustrated and described, so that citizens can recognize and destroy the cocoons and egg masses, which is the simplest and most economical method of destroying the pest.

The first pamphlet gives a short history of the establishment of the office and the ordinance governing its activities.

The second pamphlet is an argument for planting and caring for trees, gives twelve reasons for planting them and a list of ten cities having forestry departments for which appropriations were made in 1908, and the list is not complete. The appropriations listed vary from $1,504 in Minneapolis, Minn., to $42,000 in Newark, N. J.

The third pamphlet gives some of the causes destructive of tree life, preventive remedies and suggestions and directions for the removal of dead trees and the trimming of those that are unsightly.

The fourth pamphlet tells what trees to plant and how to plant them.

This is a good beginning, and while results are slow, the forester can soon demonstrate his value and thus secure the financial backing he must have.

Too many cities, large and small, hesitate to attack the problem, thinking it is too large and scattered and that there will be too many objections from property owners and taxpayers, but no city which has once put the matter in the hands of a competent board with expert assistants has withdrawn its support entirely, although the size of appropriations varies. The failures have been made by putting the work in the hands of incompetents, for other reasons than the value of the work, or because there was total lack of tact in the executive officers or because they were not given time enough to demonstrate the value of their work.

The problem is a large one, but, fortunately, it is one which can be worked upon with large or with small resources as may be necessary. Results must be proportional to efficient effort, however, and a small appropriation can not bring the results of a large one, other things being equal.

Beautiful as the trees of many of our American cities are, they can be greatly improved under competent supervision. The cities which are lacking in this regard will do well to study the New Jersey and Pennsylvania laws, which have been explained in this magazine, and follow their methods of procedure as closely as possible.

WOODS FOR BLOCK PAVEMENTS.

In August, 1906, the city of Minneapolis, Minn., and the U. S. Forestry Service co-operated in laying a section of pavement on Nicollet avenue, using several different kinds of wood, creosoted with several proportions of creosote oil and laid with the joints making various angles with the curb.

The methods of treating and laying the blocks are described in MUNICIPAL ENGINEERING, vol. xxxiv, p. 14, and a plat of the street is shown, giving the locations of the various test sets of blocks. There is also a table giving the results of traffic censuses taken on several days. The data of the experiment are also given, from the point of view of the government engineer, in Circular No. 141 of the U. S. Department of Agriculture.

The pavement has been in use for about three years, not long enough for a thorough test, but some judgment may be formed of the relative values of the woods from an inspection of the wearing surfaces. Mr. Andrew Rinker, the city engineer of Minneapolis, has rendered such a judgment and says that the indications are that the various woods should be arranged in the following order of preference for paving blocks: Southern pine, Norway pine, tamarac, white birch, hemlock, Western larch, and red fir.

Mr. Rinker thinks that for streets of

heaviest traffic Georgia pine should be used, and for streets of medium or light traffic Norway pine, tamarac, white birch or hemlock. He considers the fir a failure, possibly because a quick growth variety was used, for he expresses the opinion that if a closer fibred, slower growth variety had been used it would have come into the second class above named.

These results are interesting, but not particularly new, nor are they yet sufficiently differentiated to show the effects of the differences in amount of creosote and the effect of the other conditions noted.

Judging from some of the Indianapolis pavements, it will be necessary to wait more than ten years for complete data. The pavements made of blocks simply dipped in creosote, which was the earlier practice in Indianapolis, showed some of their defects within a few years, say four or five, particularly their strong disposition to swell when rained upon after a dry spell. Blocks which were treated with larger amounts of creosote lasted longer before showing the same defect, and those treated with specially refined oils intended to be as nearly insoluble in water and as nearly non-volatile at atmospheric temperatures as possible, lasted still longer. But no treatment has yet been able to withstand the protracted heat and drought of Indiana summers, and even the best pavements sometimes heave from expansion under water after a dry spell, whether in winter or summer.

However, the highest class pavements named are still first-class pavements, with surfaces practically as unbroken as at the beginning, some of them being fully ten years old. And some of the pavements made of dipped blocks are in almost as good condition after fifteen years or more of life. However, an appreciable proportion of the blocks in these latter named pavements have decayed and the cost of repairs to them seems to be materially greater. There is not sufficient detail of accounts to show exactly what is the difference in maintenance charges.

Mr. Rinker reports little trouble from swelling of blocks, and, notwithstanding somewhat higher cost, he reports that the proportion of creosoted block paving laid each year has increased from 54½ per cent of all pavements laid during 1906 to 75 per cent in 1909.

Further reports will be awaited with interest.

THE QUESTION DEPARTMENT

Night Soil Removal.

I am at present interested in the problem of the removal of excrement from the city by means of carts and would like to have any data or information you can give me along this line.

My present plan is as below given, but I would like any information bearing on the subject which you can furnish me with, as the project is in the formative state or stage.

The town will give a franchise (or exclusive contract), if legal, to some one who will undertake to remove from the city limits at stated intervals the excrement from houses, dumps, etc., and under his contract can collect from the citizens a certain toll or sum for the work.

In order to make it incumbent upon the citizens to patronize this person operating the carts, an ordinance will be passed making it necessary for all outhouses to be attended to at stated intervals, and the soil carried beyond the limits of the city. Under this ordinance the citizens would be forced to patronize the carts.

J. A. W., ————, S. C.

Chapin's "Municipal Sanitation in the United States" ($5) gives a full statement of the practice in many cities in the United States regarding the removal of night-soil, from the ordinances requiring and regulating the removal to the charges for the same and the method of collecting them. From this book the following selection is made.

If the city has no system of sewers and all the night-soil must be removed by carts

it will probably be simplest and cheapest to have the work done by contract or by day's labor under strict regulations made by the city. The cost of doing the work can be paid out of the city treasury from funds raised by taxation, since practically every one gets the service, or it can be assessed against those for whom the work is done at rates fixed by the ordinance.

Where there is a sewer system every one who can make connection with the sewer should be required to do so, reducing the cart service to a minimum. In such case those who receive the benefit of the cart service should pay for it. One of the simplest methods of securing good service is the following: The person desiring to have a vault cleaned applies to the proper authority, preferably the board of health. The sanitary officer ascertains the dimensions of the vault, either by inspection of his records or by inspection of the vault, and issues a permit for the cleaning, which states the fee which must be paid for the cleaning, the amount of the fee depending upon the amount of material to be removed. The applicant goes to the proper city official or to a bank designated and pays the fee. The permit is then an order on the contractor to clean the vault, and it is given to him or is deposited in a locked box by the receiver of the fee, from which these orders are taken by the contractor at stated times. If the work is done by the city, substitute foreman for contractor in the ordinance.

It is much better to have the work all done by a single contractor, but in any event the charges for the work must be fixed by ordinance and, in case there is more than one contractor the applicant for permit can choose his contractor from those licensed by the city.

Whether there are one or more contractors they should all be licensed by the board of health on evidence of ability to do the work carefully and according to regulations, and if there are several licensees they should either be put under bond or, which is better, be required to deposit some such sum as $25 or $50 from which the board of health can pay for any cleaning up or repair which the contractor fails to do himself within the limit of the time fixed by the ordinance for completion of a job. This time varies in different cities from two to five days. Should a contractor's deposit be drawn upon for such defects in his work, he should not be given any more orders for work until he has renewed it.

An inspector of the board of health should inspect each vault after it is cleaned, to check up its size for the office records and to see that it was properly cleaned and disinfected according to the ordinance or the regulations of the board.

At the end of each month the contractor can present his orders and the certificates of inspection of the work done under them and receive his pay at contract price, less any sum necessary to bring his deposit up to its full amount. He can be paid the full amount collected from the property owner or such smaller sum as may be agreed upon, part of the fee going to pay the city expense in looking after the matter. This method of paying the contractor and that of looking after the work are much more satisfactory than it would be to leave the arrangements and the settlement with the contractor to the property owner.

Regarding the methods of doing the work Dr. Chapin's book is quite full. The best method seems to be that of the odorless excavator, which is an air-tight tank on wheels, a hand or gasoline pump capable of pumping up the material and forcing it into the tank, a charcoal fire through which to pass the air forced out of the tank by pumping the liquid in a suction hose to draw the liquid up, and hose enough to reach the tank wagon. This does good service at reasonable cost. Where little water reaches the vault or it is a leaching cesspool in dry ground, it may be necessary to pump or throw some water into the vault to make it possible to pump the material.

Far less satisfactory are water-tight barrels with air-tight covers which can be well fastened on, to be filled at the vault, carried to a wagon and hauled away. It is very difficult to keep the barrels clean on the outside and prevent odor from them as they are handled through the street.

All tanks, barrels and wagons should be thoroughly washed and disinfected immediately after emptying. All work should be done in the day time.

The night-soil can be used for fertilizing, but in its raw state requires some time for incorporation with the soil. One city provides for its deposit in trenches not less than 3 feet deep, layers not to exceed 3 inches in depth and to be fully covered with dry earth. By using a sufficient area of land a good share of it can be kept under cultivation all the time. Pits with the deposits covered with not less than 4 inches of earth and all the surrounding soil kept thoroughly clean require less area of ground but require longer time for disappearance of the nuisance of opening up the soil again.

Fees for the work run from $1.35 a cubic yard with a minimum charge of $3, to $5.40 a cubic yard.

The board of health doubtless has power to order the cleaning of a vault which has become a nuisance, or, if necessary, to have the work done under its own orders and assess the cost against the property to be collected with other taxes.

An inspector of the board of health can pass around and serve notices to clean vaults, similar in form to the permits described above. His inspection gives the size of the vault and he fills in the amount of fee to be paid. The property owner takes the notice and pays the fee to the proper city official, when the notice becomes an order to the contractor to do

the work, as in the case of the permit.

Dr. Chapin's book gives a number of forms of notices, permits, sets of regulations, etc., in use in various cities.

An article giving the practice in a number of cities on several of the points above covered will be found in MUNICIPAL ENGINEERING, vol. xxxv, p. 8.

Cost of Pipe Sewers.

I wish information regarding the prices of sewers of 8 and 10-inch pipe, properly laid in trenches, sometimes 10 feet deep, which must be braced in places and hard digging in general, fairly heavy work, with manholes and lampholes in the line. I would like the average prices in a few localities of such sewers laid to true grade by inspection.

M. J. D., Smethport, Pa.

Average prices for such sewers are given in the December number, vol. xxxvii, p. 398, viz., 75 cents a foot for 8-inch, 95 cents a foot for 10-inch, $30 to $40 each for manhole, and $10 to $15 each for lampholes. The following figures have been published in MUNICIPAL ENGINEERING:

Vol. vi, p. 81, Hannibal, Mo., in 19 contracts for 8-inch pipe sewers the contract prices ranged from 28¾ to 79 cents a foot, to which must be added engineering and supervision cost.

Vol. xviii, p. 110, has a table of cost of sewers, based on labor at $1.50, trench 18 inches more than diameter of pipe, day's work 11 cubic yards, no sheeting, no machinery, no water. For 8-inch pipe the cost of trenching, refilling and tamping is 16 cents for 6-foot trench, 22 cents for 8, 33 cents for 10, 44 cents for 12, etc.; cost of laying pipe is 5 cents. To this must be added cost of pipe delivered on the trench, cost of replacing pavements, if any, contractor's profit, allowance for water, sheeting, accidents, etc. Cost of laying 10-inch pipe is 5 cents also and cost of trenching, refilling and tamping is 18 cents a foot for 6 feet depth of trench, 23 cents for 8 feet, 35 cents for 10 feet, 47 cents for 12 feet, 59 cents for 14 feet, etc.

Vol. xxi, p. 40, has an article on cost of sewer construction which gives cost of 8-inch pipe as 8 cents, of 10-inch 13 cents a foot, within 50 miles of pipe factory, freight to be added for greater distances. There is a diagram giving cost of trenching, refilling and tamping, which gives 25 cents as the cost for 10 feet depth of trench for 8-inch pipe and 29 cents for 10-inch pipe. Sheeting is estimated to vary from 5 to 12½ cents a foot for trenches less than 10 feet deep and 25 to 75 cents for trenches 10 to 20 feet deep for driving and removing.

Vol. xxxv, p. 195, gives sheeting cost in Peoria as 10 to 25 cents per foot of trench for driving and removing, in trenches 8 to 16 feet deep.

Vol. xxx, p. 329, gives prices at Marysville, Kan., by contract as 50 cents a foot for 10-inch and 36 cents for 8-inch pipe, manholes $28 and lampholes $7. At Jefferson City, furnishing and laying 10-inch pipe cost 17 cents and excavation and back-filling cost 19½ cents if less than 6 feet deep; 25 cents if 6 to 8; 32 cents if 8 to 10; 42 cents if 10 to 12, etc., making 49 cents a foot for total of the two items for 10-inch pipe. Manhole cost $22 if 5 feet deep and $3 for each additional foot, or $47 if 10 feet deep. In another Jefferson City contract the cost of 8-inch pipe laid was 18 cents, and of trenching and back-filling 8 to 10 feet deep was 35 cents, making a total for the two items of 53 cents. Ten-inch pipe cost 37 cents a foot laid, which would make the total cost in trench 8 to 10 feet deep, 72 cents. Manholes cost $37 if less than 6 feet deep and $2.50 for each foot over 5 feet, making $49.50 if 10 feet deep.

A recent report of the New Orleans sewerage and water board shows the following: For 8-inch pipe laid by the city by day labor, 6 to 8 feet deep, the cost was 79½ cents; when 8 to 10 feet deep, $1.04; when 10 to 12 feet deep, $1.94. Ten-inch pipe 8 to 10 feet deep cost $2.37 a foot, and when 10 to 12 feet deep cost $2.91 a foot. These prices include everything complete. The average prices of manholes built under contract were $42.50 if less than 6 feet deep, $51 if 6 to 8 feet deep, $60.24 if 8 to 10 feet deep, $75.10 if 10 to 12 feet deep. The average contract prices for 8-inch sewers complete were 67 cents less than 6 feet deep, 82 cents if 6 to 8 feet deep, $1.09 if 8 to 10 feet deep, $1.46 if 10 to 12 feet deep, $2.13 if 12 to 14 feet deep. For 10-inch pipe the average prices were $1.18 if 6 to 8 feet deep, $1.48 if 8 to 10 feet deep, $1.87 if 10 to 12 feet deep, etc. Water is troublesome for nearly the whole depth of the trench in New Orleans and sheeting is expensive.

The last annual report of the city engineer of Salt Lake City, Utah, contains some figures of total cost of sewers, including manholes, flush tanks, etc. The 8-inch sewers in this list vary in price from 92 cents to $2 a foot. The flush tanks and manholes add from 20 to 25 cents a foot to the average cost of the sewer alone.

In Ogden's "Sewer Construction" ($3) several examples of costs of construction are given. In Atlantic, Iowa, trenching and back filling cost 14.8 cents a foot for 10-inch pipe in trench 6.6 feet deep; pipe laying cost 1.3 cents a foot. At Centerville, Iowa, trenching and back filling cost 28 cents for 8-inch pipe in trench averaging about 7½ feet deep and pipe laying 1.7 cents. This book would be of much value in posting up on the matters included in the question.

It will thus be seen that there are large variations in cost of sewers, due to conditions of which there are no statements, if, in fact, it were possible to make any statements. The general average prices stated in the first paragraph may be assumed as reasonably safe for any but most exceptionally difficult construction.

Cities Using Concrete Pipe Sewers.

We desire the names of towns and cities that have installed and are now installing sewer systems using cement or concrete pipe for other other than storm water sewers. W. T. W., Reidsville, N. C.

There are many articles in back numbers of MUNICIPAL ENGINEERING on this subject. Those in the July number, vol. xxxvii, pp. 34 and 35, give names of some cities and references to previous articles. The use of concrete sewers is now so general that the full list of cities using them would be very long. The following list may be taken as representative:

Mobile, Ala., storm, pipe.

San Francisco, Cal.; San Bernardino, water, pipe.

Denver, Colo., water, pipe.

Hartford, Conn., pipe and monolithic; New Britain, monolithic; Norwalk, pipe.

Dover, Del., pipe; Wilmington, combined and intercepting, pipe.

Savannah, Ga., storm, pipe; Macon, pipe.

Boise, Ida; monolithic.

Chicago, Ill., combined, pipe and monolithic; East St. Louis, monolithic; Mattoon, drainage, monolithic; Paris, plain and reinforced; Savanna, pipe; Waukegan, pipe.

Brazil, Ind., monolithic; Elkhart, pipe; Gary; Huntington, monolithic; Indianapolis, combined and intercepting, pipe and monolithic, plain and reinforced; Michigan City, pipe; Richmond, reinforced, pipe and monolithic; South Bend, reinforced pipe and monolithic; Wabash pipe and monolithic.

Boone, Iowa, concrete pipe; Cedar Falls, monolithic; Clinton, combined, monolithic, reinforced; Iowa City, plain pipe; Sioux City, monolithic.

Louisville, Ky., reinforced.

New Orleans, La., monolithic.

Bangor, Me., pipe; Portland, over 20 years old.

Baltimore, Md., sanitary, pipe and monolithic, reinforced.

Everett, Mass., monolithic and reinforced pipe; New Bedford, monolithic and pipe over 20 years old; Newton, monolithic; Springfield, monolithic and pipe 20 years old or more; Worcester, monolithic and pipe.

Battle Creek, Mich., monolithic; Bay City, monolithic and pipe; Coldwater, combined, concrete block; Ford, pipe; Grand Rapids, combined and drainage, pipe and monolithic, reinforced; Jackson, reinforced; Kalamazoo, monolithic; Manistee, pipe about 20 years old.

Albert Lea, Minn., monolithic; New Ulm, monolithic; Red Wing, monolithic.

Kansas City, Mo., monolithic; Lexington, monolithic; St. Joseph, combined, reinforced pipe.

Billings, Mont., reinforced pipe; Great Falls, combined, monolithic; Helena, pipe.

Concord, N. H., monolithic; Dover, monolithic and pipe, 15 years old or more; Portsmouth, monolithic and pipe.

Atlantic City, N. J., sanitary, reinforced pipe; Hoboken, very old; Newark, storm sewers and water conduits, monolithic and pipe, reinforced; Plainfield, reinforced block, pipe and monolithic; Rutherford, pipe.

Brooklyn, N. Y., combined, pipe, natural cement sewers 42 years old, Portland cement sewers about 10 years old; Haverstraw, reinforced pipe; Bronx boro, New York, reinforced monolithic; Watertown, pipe and monolithic, reinforced.

Chillicothe, O., monolithic and pipe; Cleveland, monolithic, pipe and block, reinforced; Columbus, combined and intercepting, monolithic and pipe, reinforced; Dayton, monolithic, reinforced; Lancaster, reinforced pipe; Norwood (Cincinnati), monolithic; Sandusky, monolithic and pipe, reinforced; Springfield, monolithic; Toledo, monolithic and reinforced pipe.

Toronto, Ont., water, reinforced pipe.

Portland, Ore., monolithic, and pipe 20 years old.

Allentown, Pa., monolithic; Altoona, monolithic; Clearfield, monolithic; Crafton (Pittsburg), reinforced pipe; Harrisburg, monolithic; Oil City, monolithic; Reading; Stroudsburg, monolithic; Williamsport, monolithic.

Pawtucket, R. I., pipe and monolithic; Providence, monolithic.

Columbia, S. C., storm, reinforced pipe.

Aberdeen, S. D., plain and reinforced pipe.

Knoxville, Tenn., combined and drainage, monolithic and reinforced pipe.

San Antonio, Tex., monolithic.

Salt Lake City, Utah, combined and intercepting, monolithic.

Bellingham, Wash., pipe and monolithic; Seattle, monolithic.

Baraboo, Wis., monolithic and reinforced pipe; Fond du Lac, monolithic; Janesville, reinforced pipe; Milwaukee, combined, nearly 50 years old, both natural and Portland cement, pipe and monolithic; Oshkosh, pipe; Superior, pipe; Tomah, drainage, reinforced pipe; West Allis, water, reinforced pipe.

Monterey, Mex., water, reinforced pipe.

Size of Sewer—Cost of Septic Tank.

1. What is the best size sewer to use in a town of 5,000 or 6,000 population? I mean the main sewer, first, then the size of the branches.
2. What is the best kind of pipe to use for same?
3. What would be the cost of a septic tank to handle the sewage from the same size town and what expense would there be operating same? B., ———, Okla.

1. The size of sewer depends upon the amount of water used, whether sewage only is to be carried or storm water also, the gradient of the pipe, etc. It is therefore not possible to answer this question definitely. No branch should be less than 8 inches in diameter, unless it is very short and has only one or two connections. The main sewer might be 10 or 12 inches in

diameter if the fall is heavy, or may be 15 to 18 inches in diameter if there is but little fall, and the sewers are used for house drainage only. If street drainage also is to be carried, no economical choice can be made without full information regarding rainfall, character of territory, pavements, system of grades, area covered, gradients possible in sewers, etc., etc.

2. Vitrified clay pipe is most commonly used. The use of well-made concrete pipe is growing. This question is to be answered most economically from a comparison of cost of the two kinds of pipe.

3. The cost of septic tank depends on location, amount of excavation or fill, necessity for protection from high water, and for extension of outlet sewer, whether a building is erected over it, method of discharge, etc. Possibly filters as well as septic tanks may be necessary. The tanks, with cheap building over them, will cost from $1,200 to $2,500, according to details required, and filter beds would perhaps double the cost, or more, if much grading is necessary to prepare them and it is necessary to pump the sewage to them. Tanks alone would probably not cost more than $50 a year for care, if they are put in charge of a city employe who has some spare time and he hires the labor occasionally necessary for cleaning and keeping in operation. The filters would require considerably more attention if they are needed.

A consulting engineer can easily save the town his fee by the saving he can make in cost of first construction or in later cost for reconstruction by his adaptation of the plans to the work to be done.

Ordinance Regulating Domestic Animals, Etc., in City.

I would like a copy of an ordinance regulating chickens, etc., running at large.

S. D. HODGDON, City Attorney,
Webster Grove, Mo.

Following is an ordinance which may cover the case:

1. *Be it ordained,* That it shall be unlawful for the owner of any bull, bullock, steer, cow, heifer, calf, horse, mare, colt, mule, jack, jenny, goat, sheep, hogs or swine of any kind, geese or ducks (or chickens), to suffer, permit or allow the same to run at large in any public street, alley or unenclosed commons of this city, or in any one of the public parks of said city. Any person violating any of the provisions of this ordinance, upon conviction thereof, shall be fined in any sum not more than $50.

2. It shall be the duty of the police to take up and impound all cows, etc., etc., found running at large within the corporate limits of this city, and to keep and confine the same in a proper pound, to be provided for that purpose, until redeemed or otherwise disposed of as hereinafter provided.

3. It shall be the duty of the Superintendent of Police to immediately give notice in writing to the owner of any animal taken up and impounded, if known to him; (if not known, method and places of posting notices are provided).

4. If the owner or owners of any such animal, so taken up and impounded under the provisions of this ordinance, at any time before the sale thereof, shall demand such animal, said Superintendent, upon payment first made of all costs, fees and expenses, shall surrender the same to such owner; but if any such animal shall not be, by the owner thereof, redeemed, and all fees, charges and expenses paid within five days after being advertised, as provided in Sec. 3 of this ordinance, it shall be the duty of said Superintendent to sell such animal at public auction to the highest bidder, for cash.

5. The proceeds arising from such sales, after the payment of all fees, costs and expenses, shall be by said Superintendent of Police paid into the city treasury, and such treasurer, upon proper evidence of ownership, shall pay the same to the owner of the animal sold; and if no owner or proper claimant shall appear within six months from the time the money was received, the treasurer shall cause the moneys so received to remain as part of the general fund of the city.

6. It shall be the duty of the Superintendent of Police to prepare a pound for the safe keeping of animals taken up and impounded under the provisions of this ordinance.

7. It shall be the duty of such Superintendent of Police to carefully attend to and provide the animals taken up with the necessary food and water, or cause the same to be done.

8. Said Superintendent of Police shall be allowed the following fees: For taking up and impounding each animal embraced within the terms of this ordinance, the sum of 50 cents per head (which shall be paid by the owner of such animal before the same shall be released), and the sum of 50 cents per head for every 12 hours or fractional part thereof in excess of 4 hours, in which such animal or animals are impounded, for the expenses of feeding and caring therefor. And said Superintendent shall be allowed the further sum of 25 cents per head for making sale. All such fees, costs and expenses shall be paid by the owner of such animal before it shall be released. In case of sale, the Superintendent shall have the right to retain the same out of the proceeds of the sale.

9. Appropriation for constructing pound.

10. Repealing former ordinances.

11. Date of taking effect of ordinance.

Some of the provisions of dog ordinances may be applied to other animals or birds. Dog ordinances will be found in MUNICIPAL ENGINEERING, vol. xxxvii, p. 38, and vol. xxx, p. 350.

In another city "stock limits" are de-

fined, within which it is not lawful for stock to run at large. There is also a penalty for taking stock from an enclosed lot and driving it to the pound; also one for breaking into the pound and driving animals out, each being $5 to $25, as assessed by police judge. Stock policeman receives $50 a month. Pound keeper receives fees. Fees for the pound are 50 cents for catching animal, 50 cents a day for taking care of horse, cow or like animal; 25 cents a day for hog, sheep, goat, or other small animal, also cost of advertising in case owner is unknown. A penalty of $5 for draft animals and $3 for cows and small animals is also assessed. Chickens, ducks, geese or other fowls are included in the ordinances, the penalties being $1 for a single fowl and $5 for a flock running at large alone. Other provisions are as in the ordinance above quoted.

Surveyor's Tapes.

Where can I get good tapes?

M. J. D., ————, Pa.

Names of manufacturers and dealers in steel and other tapes will be found in the "Business Directory," published in each number of MUNICIPAL ENGINEERING, under the headings "Steel Tape" and "Surveyors' Instruments."

Plans for Municipal Buildings.

Can you advise where I can get a book of sketch plans of municipal buildings. Also names of architects that would sketch up plans of a proposed municipal building with view of furnishing the final plans.

T. P., Borough Engineer, ———, Pa.

There are two American books answering the description as to requirements, one being Bicknell's "Public Buildings" ($2.50), and one Palliser's "Court Houses, Village, Town and City Halls, Jails, Etc." ($2.00). Clifford A. Tinker, 5 Elm Park block, Westfield, Mass., may supply the desired sketches.

Cost of Wooden Block Paving in Indianapolis.

I am told that there is a considerable amount of wood block paving in Indianapolis. Can you give us the names and addresses of any persons who would be able to give us figures as to costs, etc., of such pavements, laid in Indianapolis? We are anxious to obtain all possible recent data on this subject.

R. E. M., Cincinnati, O.

The bids for paving in Indianapolis are received upon the linear foot of length of each side of the street, and include all the work, excavation, curb, gutter, drainage appurtenances, foundation and wearing surface, and any extra areas of street and alley intersections, etc. Only an approximate idea of the cost of each item can therefore be obtained from a study of the bids and the plans and specifications. The city engineer is required by law to make an estimate of the cost of the pavement as a limit beyond which contractors cannot go in their bids. For the purposes of these estimates he has an estimate of the unit cost of each item. In MUNICIPAL ENGINEERING, vol. xxxvii, p. 152, is an article on "Cost of Pavements," in which the cost per square yard in Indianapolis for creosoted wooden blocks on 6-inch concrete foundation, with sand cushion and asphalt or tar filler, is given as $2.40. The article is based on statistics collected by a committee of the Illinois Society of Engineers and Surveyors, and gives prices for six cities, ranging from the Indianapolis price as a minimum to $3.49 at Chicago as a maximum. Another article on p. 177 of the same number gives a compilation of prices taken from the monthly reports in MUNICIPAL ENGINEERING of contracts awarded. In this the prices for creosoted wood block pavement vary between $1.75 in Detroit, Mich., and $3.72 in Pihiadelphia, the Chicago price being quoted at $2.89.

It will be necessary to write to the boards of public works of the various cities for greater detail with respect to items and conditions, from which to determine the reasons for the variations in the quoted prices.

Design for Level Macadam Street.

Kindly send me list and prices of books on road and street making. The council here proposes putting in concrete curb and macadamizing the full width of the streets in the business section. The difficulty is that the town (2,000 population) is on a dead level plain and it is a hard matter to get drainage. By laying surface drains it is possible to get an outlet some half mile from the center of town. Is it practicable to make the center line of the street level and by putting in catchbasins at frequent intervals, to drain the street by false grading the gutters when they are made of macadam, and what should be the minimum fall for the gutter? Are concrete crossings a success on macadam roads?

H. E., ———, B. C.

Byrne's "Highway Construction" ($5); Baker's "Roads and Pavements" ($5); Aitken's "Road Making and Maintenance;" Morrison's "Highway Engineering" ($2.50); Spalding's "Text Book on Roads and Pavements" ($2); Elsden's "Roads" (5 shillings); Tillson's "Street Pavements and Paving Materials" ($5); Judson's "City Roads and Pavements" ($2), and "Road Preservation and Dust Prevention" ($1.50) are the principal books on road and street making, arranged in the order of their relative value for the conditions given in the letter.

If the street is kept reasonably clean and in good repair, the longitudinal sections can probably be worked out in some such way as that suggested. It is very seldom that there is not some such fall as 0.5 foot per hundred, and if there is so much a clean gutter will carry off the water. A good wide concrete or brick gutter will help much in the drainage, but

it will be necessary to keep the roadway in good repair next the edge of the gutter, so that the water will not stand along that edge or percolate too freely into the subsoil along its vertical surface.

In a business street the traffic should be fairly well distributed over the whole area, and it will be if the macadam is not too wide. The country traffic on such a street in a small town is often very heavy, so that it is not safe to make too definite a recommendation as to the width, but it is probable that 40 feet between curbs will be ample or more than ample, especially as it should have a commendable tendency to reduce the amount of hitching and standing of teams along the gutter, where the horses may soon dig out the macadam and give chance for much trouble.

The center line of the street can be made level or on a straight grade with a slight fall, if necessary, but the cross-drainage of the street will require the maximum usual crown at the points where the summits in the gutters occur, so that the crowning will be excessive where the gutters are deep. The writer has put two summits and three catchbasins on a nearly level block of asphalt pavement, on each side of the street, with reasonable success, keeping the center line of the street straight and on the average slope, because of a street car line. He would prefer, however, where it is possible, to give the street an undulating grade along the center, with summits at the centers of the blocks or other convenient points, and low points with catchbasins at the corners of the intersecting streets. In such cases the crowns can be varied both ways from the usual maximum, and the necessary fall to secure good drainage in the gutters can be increased or can at least be divided between the center line and the gutters, so that the crown and the depth of gutter will nowhere be excessive.

Concrete crossings on macadam roads can be made very successful. In a cold climate they must be made very deep and heavy and should be sloped off each way to make the attack of wagon wheels upon them as easy as possible. If the macadam is kept in good condition there will be no trouble, but even in earth streets, where the mud is sometimes very deep, the concrete crossings keep their places, if well constructed.

Manufacture of Paving Brick.

Will you kindly send me the title and price of some good publication on the manufacture of vitrified paving brick, and oblige? W. S. C., Billings, Mont.

There has not been much demand for books on the manufacture of vitrified paving brick, the literature on qualities and tests being sufficient for the engineers and other users of brick, and the technical part of brick manufacture being so modified by the qualities of the materials and the apparatus selected that no one has yet attempted to write a book giving the technology of paving brick manufacture. Some years ago Prof. H. A. Wheeler wrote a little book on "Vitrified Paving Brick" ($1), which give a good general description of the processes, and can probably be obtained, and W. W. Wallace wrote a still smaller book on "Brick Pavements" (50 cents), which also contains a brief description of the manufacture of the brick. Baker's "Roads and Pavements" ($5) gives a few pages to a brief description of brick manufacture.

Concreting in Freezing Weather.

I would like to have some information about using cement in freezing weather, how to help it resist the frost.

J. T. P., Carnegie, Pa.

The amount of cold which concrete will stand without injury is sometimes surprising, but when it is injured reconstruction is probably necessary, so that it is well to keep on the safe side. The small amount of heat necessary to protect the concrete during the time of taking its set is also quite surprising. Heating of the materials is often effective, but is not quite on the right principle, since the concrete is not likely to be injured during the process of mixing unless the exposure is greater than the men should be forced to stand, and the warmed materials are cooling during the process of mixing and placing, so that during the period of setting they may be reduced to a temperature too low for safety. Almost any sort of cover which is not too well ventilated, and a little heat, from steam pipe, salamander or even lantern, will do wonders in keeping the temperature of the surface, and therefore of the whole mass, high enough to allow the setting to take place, even if it is delayed by the low temperature. A brief discussion of the reasons for trouble from freezing of concrete will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 111. The results of some experiments on the effect of cold upon concrete are given on p. 114. The low temperatures of 41 and 34 degrees show higher strength of briquets than the higher temperature of 72 degrees, so that, if the temperature during setting can be raised barely above freezing point, better concrete than that obtainable in the summer results. On p. 380 is another article giving results of experiments with like showing, and also showing the results of keeping concrete at zero temperature for various periods and then raising the temperature to 70 degrees for one and seven days. Several methods of preventing freezing are described in detail, including salt for temperatures above 22 degrees, heating materials and protecting the top of the work. A combination of the last two is considered the best. Forms should be kept on much longer in cold weather and not removed until close inspection shows that removal is safe. Other articles will be found in earlier numbers.

Arc and Other Electric Lights.

Will you kindly give us information regarding incandescent, tungsten and tantalum street lighting, as compared with arc street lighting? This town is now partially lighted by arcs, and the city council now has under consideration the matter of changing the system for the greater part of the town, population 6,000, to incandescent. H. C. C., ———, Wash.

It will hardly be possible to answer this general question within the limits of this department. Reference must be made to articles upon various phases of the subject which have already appeared in MUNICIPAL ENGINEERING, and to others appearing in this number. A few general statements may be made in the way of the comparisons desired with respect to some of the important items, leaving more detailed discussions for answers to more specific questions.

There are three or four important subjects which present themselves at the beginning. One is the relative cost of installations for producing and distributing the light, which can scarcely be discussed with any satisfaction without more information than is given in the above letter. Another is the relative cost of maintenance and operation; another is the kind of illumination that is desired and the resulting distribution of lamps; another is the relative efficiencies of the various lamps. These are all interdependent and affect the question of cost of construction and operation. The following notes regarding them will perhaps be of interest and may lead to more detailed discussion and reference to discussions already printed. Most of them are taken from the *General Electric Review* and the *Illuminating Engineer*.

Dr. H. Lux has prepared a table of efficiencies of the most common sources of light, from which the following figures are taken:

Kind of Lamp.	Consumption of Energy in Watts.	Mean Spherical Candle Power.	Watts Consumed per Mean Spherical Candle (Hefner).
Electric carbon filament glow, with globe	98.2	24.5	4.09
Nernst, without reducing rheostat	165.0	94.9	1.74
Tantalum	44.0	26.7	1.65
Osram	38.3	27.4	1.43
Direct current arc	435.0	524.0	0.83
Direct enclosed arc	541.0	295.0	1.31
Flame arc, yellow	349.7	1145.0	0.31
Flame arc, white	348.0	760.0	0.46
Alternating current arc	180.6	89.0	2.03

A comparison on the basis of average cost is made by C. Henry Irvin. He assumes for a 17.7 c.p. incandescent lamp an efficiency of 3.1 watts per candle power and a cost of 10 cents a kilowatt hour, making a lamp burning 90 hours a month cost 2.8 cents per candle power per month, which, apparently, makes a small allowance for maintenance. The 165 c.p. Nernst lamp, with an assumed efficiency of 1.6 watts per candle power and a maintenance cost of 6 cents a kilowatt hour, will cost 1.52 cents per candle power per month, other conditions being as above.

The 200 c.p. arc lamp, with an efficiency of 2.3 watts per candle power, will cost 1.35 cents per candle power per month.

In MUNICIPAL ENGINEERING, vol. xxxiii, p. 348, is a comparison of cost of operating three kinds of arc lamps. The first installation was a 125 h.p. engine, operating four Jenney 25-ampere generators, using 115 i.h.p., and 78 2,000-c.p. open arc lamps, costing $80 per lamp per year. The engine remaining the same, the lighting apparatus was replaced by a No. 12 General Electric Brush 6.6 ampere generator, using 101 i.h.p., and 116 2,000-c.p. enclosed arc lights, costing $56 per lamp per year. Later this system was replaced by a No. 13 General Electric Brush generator, using 78.6 i.h.p., and 132 magnetite lamps, costing $47 per lamp per year for operation. With the same engine that operated 78 open arc lamps, 155 magnetite lamps will be operated.

The committee on street lighting specifications of the National Electric Light Association made a comparison of arc lamps in terms of 16 c.p. incandescent lamps. A 4-ampere, direct current, series, luminous arc lamp is equivalent to 30¼ 16-c.p. incandescents. A 9.6-ampere, direct current, series, open arc; a 6.6-ampere enclosed arc; and a 7.5-ampere, alternating current, series, enclosed arc, are each equivalent to 16 of the 16-c.p. incandescents. A 6.6-ampere, direct current, series, open arc; a 5-ampere enclosed arc; and a 6.6-ampere, alternating current, series, enclosed arc are each equivalent to 12¼ of the 16-c.p. incandescents. A 5.5-ampere, alternating current, series, enclosed arc is equivalent to 9 of the 16-c.p. incandescents, installed in the same place in each case.

In MUNICIPAL ENGINEERING, vol. xxxvi, p. 216, is a comparison of tungsten lamps with arc lamps. In brief, the statement is made that 10 of the 32-c.p., 8 of the 40-c.p., or 5.3 of the 60-c.p. tungsten lamps can be operated with the same power that operates one alternating current enclosed arc lamp. On account of the better distribution of light the author assumes that 3 60-c.p. tungsten lamps will give better service than one arc lamp. He assumes the arc lamp to cost $80 a year, and, allowing for extra lamp supports and apparatus, he computes the rate for the tungsten lamps at $22 each, or $66 for the three which displace the one $80 arc lamp.

Oliver F. Bristow gives an example of

the value of substitution of tantalum lamps for carbon filament lamps. He states that the watt meter showed the 16-c.p. carbon filament lamps to be taking 65 watts each, or 4.01 watts per candle power, while the 20-c.p. tantalum lamp required 40 watts, or 2 watts per candle power (compare with the above table). The estimated gain in capacity by substitution of an equal number of tantalum for carbon lamps was 25 kilowatts, which is estimated to be worth $2,500. Interest, depreciation, taxes, and cost of operation of this capacity is computed at $700, while the difference in cost of the two kinds of lamps, assuming 1,000 lamps in service, is $340, leaving $360 for the trouble of making the change and for profit.

The University of Illinois has made tests of carbon filament, metallized carbon filament, and tantalum lamps, with reference to various important characteristics, two of the conclusions being as follows: The same electric energy is required to operate a 16-c.p. carbon, a 20-c.p. metallized carbon and a 22½-c.p. tantalum lamp, and the number of lamps of each, with the same candle power, operated by the same current, would vary in the inverse order. The carbon lamp has reduced to 80 per cent. of its original candle power in 400 hours of use, the metallized in 780 hours, and the tantalum lamp in 820 hours, under good operating conditions. Under bad operating conditions, fluctuating currents, etc., the lives were 225, 350 and 350 hours, respectively.

Frank W. Willcox makes a detailed comparison, which results in the statement that the total cost of power and lamps per 100 candle hours at 10 cents a kilowatt hour for power is 3.63 cents for a 16-c.p. 50-watt carbon filament lamp; 2.93 cents for an 18-c.p. 50-watt metallized carbon lamp; 2.43 cents for a 20-c.p. 40-watt tantalum lamp, and 1.71 cents for a 40-watt tungsten lamp. These are merely examples of the many conditions covered in the author's comparisons.

The general principles of street lighting on which the choice of lamps for various districts in a city should be based are well stated in the article on "Street Lighting," to be found on another page in this number of MUNICIPAL ENGINEERING. Many other articles will be found in preceding volumes.

Plans for Concrete Conduit.

This city intends having constructed a 5-foot concrete conduit about 1,400 feet long, with a 5-foot gate valve, for the purpose of disposing of storm waters. Will you please send me, as a subscriber of your paper, some plans and specifications for such work, with contract? I desire to have something that has been approved. H., City Attorney, ——, Miss.

It would not be safe to accept plans for such a conduit made for one place under conditions quite probably different from those existing here, especially if there is to be a gate under pressure, and liable to the troubles which gates and their surrounding structures may have. The only safe way in so important and expensive a work as this seems to be is to secure a competent engineer to make a careful inspection and survey of the work to be done, upon which to base plans and specifications, and he can work out with the city attorney, who is familiar with the laws of Mississippi, the terms of a contract with some one who will undertake the work under these plans and specifications. The engineer will be worth his fees in the savings he will make in the construction cost if the work is made heavier than necessary, or in damages and cost of reconstruction if the work should be built too cheaply and should fail.

Some idea of what others have done in the way of building 5-foot conduits and in making specifications and contract for the work may be gained from a perusal of the following articles in MUNICIPAL ENGINEERING:

Vol. xxxvii, p. 145: "The New Pittsburg Filters," showing a photograph of the large reinforced concrete filtered water conduit under construction.

Vol. xxxvii, p. 289: "The Los Angeles Aqueduct," showing photograph and plans for concrete channel and tunnel somewhat larger in dimensions.

Vol. xxxvi, p. 21: "Concrete Sewer Construction in Chicago," describing the construction of a concrete sewer varying in diameter from 4½ to 5½ feet.

Vol. xxxvi, p. 220: "Planning the Clinton Sewers," giving the principles of the design of concrete and reinforced concrete conduits from 4 to 10 feet in diameter.

Vol. xxxvi, p. 297: "The College Avenue Sewer, Indianapolis, Ind.," giving description and photographs of construction of concrete sewer 2½ to 8 feet in diameter.

Vol. xxxvi, p. 300: "Methods of Sewer Construction in Clinton, Iowa," giving quite detailed instructions for the work of building brick, plain concrete and reinforced concrete sewers or conduits, including 5-foot circular plain concrete.

Vol. xxxv, p. 71: "Methods and Cost of Constructing Concrete Sewer" 7 feet in diameter.

Vol. xxxv, p. 148: "The Big Cottonwood Water Works Conduit of Salt Lake City, Utah," somewhat less than 5 feet in diameter, illustrated.

Vol. xxxiii, p. 73: "The Metropolitan Water Supply System," giving several forms of conduit construction for the Boston water supply.

References to earlier articles will be found in vol. xxxiii, p. 252.

Much information on the subject can be obtained from such books as Taylor and Thompson's "Concrete, Plain and Reinforced" ($5) and Gillette and Hill's "Concrete Construction Methods and Cost" ($5). The best form of specifications for such work will be found in the "Hand-

book for Cement Users" ($3), from which a set suited to the special conditions can readily be selected.

Elsewhere in this number of MUNICIPAL ENGINEERING will be found extracts from specifications of the United States Reclamation Service for a reinforced concrete conduit 4 feet in diameter, part of it under pressure of as much as 50 feet of water. Possibly the conduit proposed by our correspondent could be made of plain concrete more economically, especially such parts of it as are not under pressure of water from within nor of water or earth from without.

Filtering Intake for Water Supply from River.

My company is bound to put in a better, clearer water in future, and I suggested putting in a percolation system in the Ohio river. A number of them are used, and while this system may not be at all advisable in some other rivers, we have the ideal location, there being coarse sand not less than 20 feet deep, and the percolation shells can be sunk and connected to suction main at less cost than any mechanical filter. I give you a crude sketch herewith, and if you can give some information on the subject and the name of a reliable contractor, I will appreciate your effort to assist me.

A. S., ———, Ky.

The sketch shows a pump well with a suction lift of 25 feet at extreme low water, an 18-inch suction pipe 450 feet long, extending under the bed of the river to a double row of cast iron shells, each 4 feet in diameter and 6 feet long, set in pairs, shells being 12 feet from the suction pipe on each side and the pairs 12 feet apart, and connected with the suction pipe by 12-inch pipes. It is estimated that ten of the shells will have a capacity of 2,000,000 gallons in 24 hours.

Can our readers give any suggestions regarding the proposed method of getting water?

The following questions suggest themselves:

Is not the suction lift too great in case the wells close up so that draft on them is difficult? Would better results be obtained if the pump well were deep enough so that the pipe from the shells drained by gravity to it, especially in length of life of the wells? Would ordinary 6 or 8-inch driven wells in larger numbers be preferable to the 4-foot shells in cost, ease of installation and ease of removal for cleaning? Could each of the shells be set over some well-strainers extending down toward the bottom of the sand stratum, thus increasing the area of sand from which water could be drawn?

This latter suggestion calls to mind the horizontal wells which are sometimes used in similar circumstances when the depth of sand is not sufficient to give the length of strainer necessary for good flow from vertical wells. By driving the pipes horizontally, say 25 feet apart, strainers 30 feet long or more can be put at the ends of, say, 6-inch suctions pipes connected up to 8, 10 or 12-inch branches from the main suction pipe.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

An Experience with Cement Lined Pipe.

In a recent paper, Leonard Metcalf, consulting engineer, of Boston, cites the experience of the city of Waltham, Mass., in the use of cement lined pipe, which, though now abandoned, was in use long enough to present some very interesting results, as here presented.

Waltham had a population in 1905 of 26,282. Water works were constructed in 1872, the mains being cement lined pipe. In 1887 the further use of this pipe was practically abandoned, and since that time substitutions have been made until at the present time there is left only about one mile of cement pipe. In 1887 there were about twenty miles of cement lined pipe, ranging in size from 4 inches to 16 inches. The reason given for giving up the use of this pipe was leaks in the joints, also trouble in making connections and care necessary in opening and shutting gates to prevent water hammer, which is liable to cause breaks.

On July 4, 1879, lightning caused the

destruction of 300 feet of 6-inch pipe, cast iron being substituted at a cost of $263. July 12, 1883, lightning again caused a small leak, and it was repaired at a cost of $20. August 3, 1889, 32 feet of 4-inch pipe was destroyed, and on August 12, 1891, 1,070 feet of 6-inch pipe was destroyed by lightning.

The Waltham report for 1895 contains reference to electrolysis in connection with the cement lined pipe, and states that several pieces dug up near the electric car tracks were badly pitted and that the pipe was rendered practically worthless.

During this period there were about twenty miles of cement lined pipe in the system.

Year.	No. of Leaks in Cement-Lined Pipe.	Total No. of Leaks.	Cost of Repairs on Cement-Lined Pipe.	Cost Per Leak.	Cost Per Mile.
1883	13	19	$232.00	$17.84	$11.60
1884	15	27	245.00	16.33	12.25
1885	6	13	45.00	7.50	2.25
1886	7	12	400.00	57.15	20.00
1887	5	12	154.00	30.80	7.70
1888	8	10	179.00	22.38	8.95
1891	37	41	1,092.00	29.52	54.60
Average	13	19.1	$353.30	$25.79	$16.76

The large number of leaks noted in 1891 was partly due to the beginning of construction of a sewerage ssytem in the city. Laborers, in digging trenches for sewers, caused damage to the water pipes. It should be noted that the cost of repairs given in the above table generally includes the substitution of cast iron for the old cement lined pipe.

U. S. Specifications for Reinforced Concrete Pressure Pipe.

Following are selections from specifications governing the construction of reinforced concrete pipe under pressure varying from zero to 60 feet head of water, selected from specifications prepared for the Buford-Trenton project in North Dakota by the United States Reclamation Service.

The general conditions, not given, cover such subjects as form of proposal, certified check, bonds, definitions of terms, methods of laying out work, materials and workmanship, suspensions, delays, unit prices, changes, extra work, inspection, defects, etc.

The general provisions describe the work to be done, list the drawings, define times of commencement and completion, manner of making payments, divisions of the work, and include specifications for other work than that selected below.

EXCAVATION.

Description.—The price stipulated for excavation shall include the cost of damming, pumping, bailing, draining, sheeting, bracing and all other work necessary to maintain the excavation in good order during construction.

Classification of Material.—All material moved in grading shall be measured in excavation only, and estimated by the cubic yard under the following classes:

Class 1. All material that can be plowed by a six horse or six mule team, each animal weighing not less than 1,400 pounds, attached to a suitable breaking plow, all well handled by at least three men; also all material that can, without plowing, be handled in scrapers, including all detached masses of rock two cubic feet or less in volume.

Class 2. All detached masses of rock more than two and less than twenty cubic feet in volume, and all indurated material and hardpan, if any, that cannot be plowed as described under Class 1, but that requires loosening by powder and can then be removed in scrapers.

Class 3. All rock not included in above classes that requires drilling and blasting.

Class 4. All excavation below the plane of saturation.

Overhaul.—All material taken from the excavation and required for embankment or other purposes must be placed where directed by the engineer. The limit of free haul shall be 200 feet. All haul of over 200 feet, where the material is needed for embankment or other purposes, will be paid for at the rate agreed upon in the contract per cubic yard per hundred feet of additional haul, but no allowance will be made for overhaul where the excavated material is wasted, except where such overhaul is ordered by the engineer. The length of haul shall be understood to mean the distance from the center of gravity as found in excavation to the center of gravity of the material deposited, leaving out of consideration the material that is excavated and deposited between the same two adjacent stations.

Clearing, Grubbing and Preparation of Surface.—The surface of all excavation that is to be used for embankments and the ground under all canal embankments must be stripped of all brush and vegetable matter of every kind; the stumps and roots of shrubs shall be grubbed to a depth of six inches below the surface of the ground and burned with the other combustible material removed, and the ground under the embankments shall be well plowed. Where the ground is free from trees and shrubs, the cost of the preparation of the surface will be included

in the price bid for excavation. Where the ground is covered with a growth of trees and shrubs the work will be paid for at the price bid per acre for clearing and grubbing, and will be estimated under the following classes, but in no case shall any area be considered as belonging to more than one class:

Class 1. All shrubs of the size and nature of the so-called rose bush and buck brush that can be readily cut by a suitable machine and the ground plowed by a team.

Class 2. All shrubs of the size and nature of the so-called basket willow and kinnykinic.

Class 3. All shrubs of the size and nature of the so-called boxelder, diamond willow, and ash up to a diameter of six inches, measured not more than one foot above the surface of the ground.

Material Laid Aside.—Where any material suitable for use in structures, such as sand, gravel or stone, is found in the excavation, it shall, if so ordered by the engineer, be laid aside in some convenient place designated by him. No extra allowance will be made for this work except for required overhaul.

Riprap.—Riprap will be required in the vicinity of pressure pipes, culverts and structures at the creek crossings, and also at such places as the engineer may direct. The riprap shall be laid upon a foundation of gravel or small stones six inches in depth. Upon this foundation the riprap shall be laid by hand, with the base of each stone bedded in the foundation and with the top conforming to the grade of the surface required. All spaces between the stones used for riprap shall be filled by smaller stones and gravel. The riprap shall be from six to twelve inches thick, as directed by the engineer, and no stones shall be of less depth than the thickness required. In computing the volume of riprap, the depth will be the required distance between the surface of the rock and the bottom of the gravel foundation, and payment will be made at the price bid per cubic yard for the material in place.

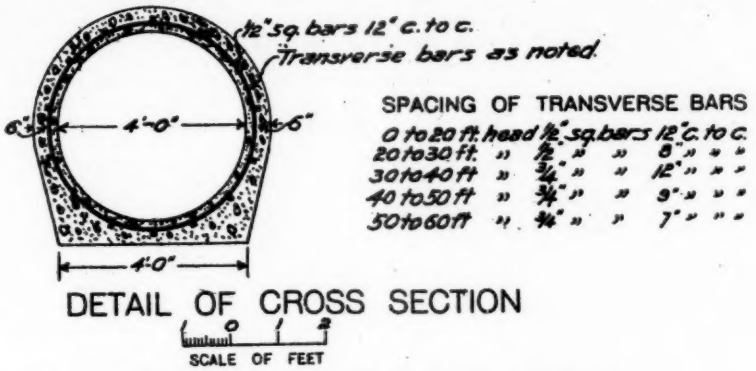
CONCRETE.

Classification and Payment.—All concrete will be divided into the following two classes: Class 1, Plain concrete; Class 2, Reinforced concrete. Only that portion of any concrete wall or structure will be considered as belonging to Class 2 that actually contains steel reinforcement. Concrete of the class specified will be used in such places and shall be of such forms and dimensions as may be shown on the plans or ordered by the engineer. When the conditions make it desirable to reinforce the concrete by the use of imbedded steel, the details will be shown on the plans or furnished by the engineer. The price bid per cubic yard for concrete under Class 1 shall include all necessary forms, protective work and pumping, the furnishing of all material except cement, and haulage of all material, including the cement. The price bid for concrete of Class 2 shall include, in addition to the above, the hauling, cutting, bending, welding, wiring and placing of steel for reinforcing.

Cement and Reinforcing Steel.—All cement and all steel for reinforcement will be furnished by the United States. They will be delivered to the contractor f. o. b. cars at the railroad station most convenient to the work. The contractor will be held responsible for demurrage to the railroad company, and shall haul the cement and steel from the railroad station to the work. He shall furnish suitable warehouses or sheds for storing the same until used, and will be held responsible for any loss of or damage to cement or steel after their delivery at the railroad station. If the cement is shipped in sacks, the contractor will be held responsible for the return of the full number of sacks to the railroad station in serviceable condition, and for all sacks not so returned he will be charged at the rate paid by the United States. The contractor must give the engineer at least sixty days' notice in writing as to when and where he wants cement delivered, and shall state the amount required, which must be expressed in carload lots, as far as practicable.

Sand.—The sand shall be composed solely of hard, durable particles, and must not contain more than 10 per cent. of clay. All the sand shall be of such size as will pass through a screen with a clear one-quarter-inch square mesh, and shall be so graded that the voids in the dry, well-shaken material shall not exceed 35 per cent. of the mass.

Mixing.—If the concrete is mixed by machine, such machine and its operation shall at all times be subject to the approval of the engineer, and if at any time it fails to perform the mixing in a satisfactory manner, it must be removed at once and another machine substituted therefor. If hand labor is used, the mixing of the concrete shall be done in the following manner: A tight floor, either of planks or sheet iron, shall be used for the mixing in all cases. The sand shall first be piled on the floor with the cement in the required proportions. The mass shall then be shoveled over as many times as are necessary to make a thorough mixture of sand and cement. Sufficient water shall be added to make a stiff mortar and the mass shoveled over once or twice more, as may be necessary. The stone or gravel, which shall be well wet, shall then be added, and the entire mass shoveled twice or more before shoveling into the carriers. Concrete shall be mixed in such small and convenient quantities as will allow it to be used very soon after being mixed; and any portion of a batch that has acquired initial set before being placed must not be used, and must be removed at once from the vicinity of the work. In no case will concrete be permitted to re-


½" sq. bars 12" c. to c.
Transverse bars as noted
6"
4'-0"
6"
4'-0"
SPACING OF TRANSVERSE BARS
0 to 20 ft. head ½" sq. bars 12" c. to c.
20 to 30 ft. " ½" " " 8" " " "
30 to 40 ft " ¾" " " 12" " " "
40 to 50 ft " ¾" " " 9" " " "
50 to 60 ft " ¾" " " 7" " " "
DETAIL OF CROSS SECTION
0 1 2
SCALE OF FEET

REINFORCED CONCRETE PIPE UNDER PRESSURE.

Buford-Trenton Irrigation Canal, North Dakota.

main in the work if it has begun to set before tamping is completed.

Water for Mixing.—The water used for mixing shall be reasonably clean and free from organic matter.

Gravel or Broken Stone.—Stone for concrete shall be sound, clean gravel or broken rock approved by the engineer. Except where otherwise specified, it shall be of such sizes that it will pass a screen having two and one-half inch round holes and be retained on a screen having one-quarter inch square holes. The finer particles passing through the one-quarter inch screen may be used as sand in forming the concrete, when complying with the requirements of paragraph on sand, above.

Proportions of Materials.—The proportions of materials in concrete for each piece of work shall be such as may be required by the engineer.

Placing.—Under no circumstances shall concrete be laid in deep or moving water or on a muddy foundation. When so ordered by the engineer, suitable foundations of broken stone, gravel or timber shall be provided by the contractor and will be paid for by the United States as extra work. All surfaces upon which concrete is to be laid shall be clean and thoroughly wet before the concrete is deposited. All concrete shall be well tamped, if put in "dry," with heavy tamping bars, until a film of water appears on the surface; and if "wet," with suitable bars, shovels or other implements, so that porosity and rough surfaces may be avoided. Concrete shall be used "wet" whenever practicable, and "dry" only when the nature of the work renders such use unavoidable. No concrete shall be placed during freezing weather unless special permission is granted by the engineer, in which case it shall be mixed, placed and protected in such manner as he may direct. No extension of time will be allowed the contractor for delays in concrete work due to freezing weather. In finishing a day's work or whenever leaving a face of concrete to which other concrete is to be joined, a suitable key, or bond, satisfactory to the engineer, of such dimensions as may be required to insure a strong, water-tight bond shall be left in the surface or face of the concrete. Whenever new work is joined to old, the surface or face of the old work shall be thoroughly cleaned of all dirt or loose matter of every kind, thoroughly wet, and coated with neat cement as the new work is started. The pressure pipes or other structures in which water-tightness is essential shall be built in monolithic sections of such lengths that the work in a section may be completed during one working day. Whenever steel is imbedded in concrete special care shall be taken in ramming the concrete around the steel to secure perfect contact between them without disturbing the steel.

Inspection.—All concrete shall be mixed and laid in the presence of an inspector and to the satisfaction of the engineer.

Protection.—The contractor shall keep all concrete wet by sprinkling with water, or by covering with earth or other material, or both, as directed by the engineer, until the cement is sufficiently set. He shall provide such facilities for protection of finished work as may be required to secure satisfactory results.

Finishing.—The inside surfaces of all conduits and approaches forming part of the waterway of the canal shall be given a smooth finish by proper manipulation of the concrete and by using planed lumber with tight joints for forms. Immediately upon removal of the forms, voids, if any, shall be filled with mortar and all exposed surfaces shall be given two coats of cement grout evenly applied with a suitable brush.

Forms.—Centers and other forms shall be smooth, true to shape, and strong enough to withstand without movement the strain of ramming the concrete against them. The lagging used shall be of even thickness, planed on the edges and on the side next to the concrete, and shall be placed with tight joints.

Anchorage of Steel Bars.—In pressure pipes the transverse bars shall be welded at the joints so as to form continuous rings. In other cases the bars shall be anchored in the concrete by bending or other deformation, and at splices or joints bending or wiring, or both, will be required. The cost of all work of this nature shall be included in the price bid for concrete of Class 2.

Pressure Pipe.—From the pumping station there shall be constructed a pressure pipe of reinforced concrete, about 2,700 feet long, leading to Canal "A." The interior diameter of this pipe will be about four feet, and it shall be constructed as shown on drawing. It must be built in complete sections of such lengths as can be finished each day. The forms, methods of placing concrete, and tamping or shaping must be satisfactory to the engineer. When a section is commenced, it must be carried through continuously without delay in setting forms or placing concrete, so that there will be no tendency to form seams or cleavage planes. The vertical joints between sections shall be roughened or mortised to the satisfaction of the engineer, and the longitudinal reinforcing rods must be left projecting from each section. After the forms are filled with concrete, they must be kept saturated with water, and immediately after the removal of the forms all voids in the concrete must be carefully filled with mortar and the inside of the pipe must be given two coats of cement grout applied with a brush. The outside surface of the pipe must then be protected from the sun by covering with earth or other suitable material, and the covering must be kept saturated with water until the backfilling over the pipe is in place. The concrete shall be mixed and placed as provided in paragraphs above. The pressure pipe shall be reinforced with steel as shown on drawing. The steel shall be placed under the requirements of paragraphs above. The trench for the pipe shall be excavated to such lines as to give sufficient room for the necessary forms and for spading and tamping the concrete. After the outside forms have been removed the trench shall be refilled, and to the elevation of the top of the pipe the material shall be thoroughly compacted by tamping or some other method approved by the engineer. The cost of all work of this nature shall be included in the price bid per cubic yard for "trenching and backfilling." The pressure pipe will be paid for at the price bid for "trenching and backfilling" and concrete for the classes required.

Cost of Concrete Culvert.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The skew culvert shown in the accompanying photograph has a straight

REINFORCED CONCRETE BRIDGE AT INDIANA, PA.

span of 12 feet, the face on the skew is 17 feet long, and the abutments are 32 feet long. There is a 6-inch concrete paving in the bed of the stream. The abutments extend to good foundations and are 3 feet thick to top of the paving and then taper to 2 feet at the base of the slab which is the concrete floor, 12 inches thick and reinforced with 19 60-lb. rails, each 13 feet 6 inches long, and of the full outside dimensions above given. Parapets are 12 inches high and 5 inches thick, on which are set the pipe railings.

The concrete was mixed by a Smith mixer and all put in place in one day of 10 hours. Wages on the work, laborers, $1.50 per day; foreman, $3.00; machine man on mixer, $3.00.

The following table gives the cost in detail:

	Cost.	Per yd.	
Excavation	$38.50	$0.5661	
Cement	81.60	1.200	At $1.20 per barrel.
Sand	47.80	.703	At $1.25 per ton.
Stone	95.60	1.406	At $1.25 per ton.
Forms	25.00	.3676	
Placing forms	15.50	.228	
Mixing	57.50	.846	Mixing and depositing.
Steel rails	76.80	1.129	Railroad rails at $30 a ton.
Carting	8.00	.118	
Incidentals	8.15	.120	
	$454.45	$6.683	Total yardage, 68 cu. yds.

The culvert was designed by Thos. Pealer, borough engineer, and built by M. Bennett & Sons, contractors, Indiana, Pa. The pipe railing was put on by the borough and was not in the contract for the culvert.

THOS. PEALER,
Borough Engineer, Indiana, Pa.

MUNICIPAL MATTERS IN COURT

Higher Courts—Damages by Power Plant—Iowa City Debt Limits—Utica Water Rates

Decisions of the Higher Courts of Interest to Municipalities.

PREPARED BY JOSEPH W. KENNEY, ATTORNEY-AT-LAW, INDIANAPOLIS, IND.

Contract With Architect—City Can Not Reduce Compensation.—When a city agrees to pay a firm of architects a certain percentage on the cost of construction of a fire and ice boat, in consideration of their services in preparing the plans and specifications for the boat, the city can not reduce the compensation agreed upon after the architects have done their work by eliminating the fire features of the boat and thereby reducing its cost of construction.—Melville v. City of Philadelphia (Pa.), 38, Pa. Super. Ct. 326.

Condition in Contract Requiring Guarantee of Uninterrupted Supply of Brick is Proper.—A condition of an advertisement for bids for street paving, requiring the bidder to furnish a certificate from the manufacturer of the brick to be used guaranteeing an uninterrupted supply within the time fixed for completing the contract, was not unreasonable, but proper.—O'Neill & Viscount v. City of Elizabeth (N. J.), 73 A. 872.

Contractor's Guarantee of Pavement Contemplates Use of Street by Street Railway.—Where at the time a contract for paving a street was made which contained a guarantee by the contractor to maintain the pavement in good condition for ten years, making all necessary repairs without further charge, a street railroad was being operated on the street, the contract must be presumed to have been made in the light of such fact, and the contractor cannot avoid obligation on its guarantee on the ground that the pavement was broken because of the insufficiency of the foundation of the street railway tracks, nor because during the ten years the city renewed the grant to the street railway company, nor because heavier cars were used by such company, all of which must be presumed to have been within the contemplation of the parties.—City of Akron v. Barber Asphalt Pav. Co. (U. S .C. C. A., Ohio), 171 F. 29; Barber Asphalt Pav. Co. v. City of Akron, Id.

Legality of Contract Not Affected by Illegal Assessment to Meet Payment Therein Provided.—In an action by a city on a guarantee, in a contract for paving, that the contractor would keep the pavement in repair for ten years, where the contractor received payment for the work in full, it has no interest in the source from which the money was obtained which entitles it to set up as a defense that the contract was illegal because the city made a special assessment on abutting property for the entire contract price of the work, although it had no power to levy such assessment for repairs, it having undoubted power to contract for the repairs and to pay for the same from its general fund.—Id.

Overflow of Water Arising from Changes in Character of Surface of Streets

—City Not Liable.—A city is not liable to a property owner for the increased uow of surface water over or onto his property, arising merely from the changes in the character of the surface produced by the opening of streets, building of houses, etc., in the ordinary and regular course of the expansion of the city.—Barrett v. Minersville Borough (Pa.), 38 Pa. Super. Ct. 76.

Departure from Contract Fixing Grade of Sewer—Insufficient Cause for Enjoining Assessment.—Where by the inadvertence of the engineer employed to fix the grade of a sewer, the contract has been departed from as to its depth, without affecting its cost or efficiency, and the error is not discovered until after the completion of the work, an assessment will not for that reason be enjoined, no substantial injury to the lot owners being apparent.—Close v. Parker, 30 Ohio Cir. Ct., R. 384.

Adoption of Road as Street—Discretion of City Authorities.—When a city acquires the property of a plank road or turnpike company, the duty which it assumes is to keep the highway in repair, and the character of the highway is not changed. The city may adopt such road as a paved street, no matter how or with what material it was paved. No such adoption as a paved street can be inferred from laying water pipes in the street, or lighting it or collecting garbage and ashes from houses on it, or requiring persons to take out a permit for making openings in it, or permitting the operation of an electric railway on it, or the paving of the center of the street with vitrified brick by the railway company.—City of Philadelphia v. Hafer, 38 Pa. Super. Ct. 382.

Use of Unbarricaded Street Not Contributory Negligence.—So long as streets remain unbarricaded and open to public use, there is an implied invitation for the use, and a person using them is not negligent unless he has knowledge of the dangers incident to the proper use thereof, and the mere knowledge of the general unsafe condition of such a street on the part of one using it with a right to do so would not render him negligent.—Scurlock v. City of Boone, 121 N. W. 369.

Buildings Upon Lands Leased from City Not Assessable for Taxation as Real Estate.—The buildings, equipments, etc., of a filter plant erected on land belonging to and leased from the city of Lancaster are not taxable for local purposes separate and apart from the land, as it is not real estate.—East Lampeter Township v. Maignen Filter Plant, Owner, etc., 26 L. L. R. 396.

Defect in Sidewalk—City's Liability for Resulting Injury.—A city is not liable for an injury from a defect in a sidewalk or street unless the defect was created by the city or with its knowledge, actual or constructive, and it was negligent in not repairing it within a reasonable time after it knew or should have known thereof.—City of Portsmouth v. Houseman (Supreme Ct. Va.)

Injury to Property Resulting from Change of Grade—Abutting and Non-abutting Owners—Damages.—Where a non-abutting owner claims damages by reason of a street improvement, the burden always rests upon him to show immediate and substantial injury occasioned thereby. As to non-abutting owners, there can be no claim for property actually taken, and the damages, if any, must be such as result from some consequential injury, which must be proximate, immediate and substantial.—Ogontz Avenue Case, 225 Pa. Supreme Ct. 129.

Municipal Regulation of Billboards on Private Property.—So long as billboards erected upon private property are secure against falling upon the passerby, so long as they entail no risk of fire within proper fire limits, so long as they do not smell bad, or spread disease, and so long as they do not offend the moral instincts of mayor and police, they enjoy absolute constitutional immunity. An ordinance based upon the grounds herein suggested is within the legitimate bounds of police regulation.—Galland v. City of Wilkes-Barre, Pa. Supreme Ct.

Stones Along Highway Frightening Horse—Not Negligence if Properly Located.—It is held that a city cannot be held liable for injuries due to the frightening of a horse by stones, which, for the purpose of repairing a highway, it had piled along the curb out of the traveled path, if it has used due care in their location, notwithstanding they are permitted to remain longer than is absolutely necessary before the injury occurs.—Elam v. Mt. Sterling (Ky.), 20 L. R. A. (N. S.) 512.

Dangerous Condition in Street—Reasonable Time to Remedy.—Whether such reasonable time has elapsed between the origin of a dangerous condition in a street and an injury to a traveler as to have enabled the city to have remedied such conditions, is for the jury. Defendants' failure to inspect the street for a week held not negligence as a matter of law.—Revis v. City of Raleigh (N. C.), 1909.

First Pavement Defined.—A "first pavement" in the legal sense, which exempts the abutting property owner from liability for any subsequent improvement, is one that is put down originally, or adopted or acquiesced in subsequently, by the municipal authority, for the purpose of changing an ordinary road into a street, and may be of macadam or anything else; but, if the purpose be wanting, a mere surfacing of the road will not be a paving.—City of Philadelphia v. Hafer, 38 Pa. Super. Ct. 382.

Roadbed of Railroad Not Subject to Assessment as Real Estate.—The roadbed of a public railroad is not "real estate" within the meaning of Act June 4, 1901 (P. L. 364), providing that "all real es-

tate * * * shall be subject to all tax claims and municipal claims herein provided for," and is not subject to assessment for laying a water pipe in a street on which the right of way abuts.—City of Philadelphia v. Philadelphia & R. R. Co., 38 Pa. Super Ct. 529, 531.

Departure from Specifications in Improvement Releases Abutting Owner from Obligation to Pay.—A lot owner is not bound to pay for a sidewalk built by the municipality, where the materials used were different from those specified in the resolution providing for the walk and the notice to abutting owners, and collection of the assessment for the improvement will be enjoined.—Meek v. Village of Collinwood, 30 Ohio Cir. Ct. R. 63.

Street Improvement Not in Accordance with Contract—When Property Owners Must Raise Objection.—The owner of property abutting on a street improved by the city cannot avoid an assessment against the property by showing that the improvement was not done in accordance with the contract, as that defense must be raised at the confirmation of the assessment, made at a hearing of which he had notice, as provided by law.—City of Woodlawn v. Durham (Ala.), 50 So. 356.

Assessments Must Be Grossly Excessive to Be Reduced by Court.—Assessments must be grossly excessive to warrant reduction by a court of equity.—King v. City of Dayton, 30 Ohio Cir. Ct. R. 480.

Sewer Assessment—District Deemed to Be Benefited.—If a main sewer is adequate and so located that it can be utilized in the future by the construction of convenient laterals, the lands in the whole district will be deemed specially benefited. It is not necessary that property be improved so as to make sewer connections immediately available.—Idem.

Ordinance Prohibiting Operation of Stone Quarry Invalid.—A city ordinance, prohibiting the maintaining or operating of a stone quarry within the city limits, is invalid as an attempt to prohibit rather than regulate a legitimate business.—Pacific States Supply Co. v. City and County of San Francisco (U. S. C. C., Cal.), 171 F. 727.

Unguarded Excavation Under Permit to Contractor—Owner of Property Liable for Injuries to Pedestrian.—Where a pedestrian on a public sidewalk falls into an excavation made for the purpose of making sewer connections with houses in course of construction, the owners of the houses are liable for the resulting damages, if the excavation was unguarded, and the permit issued to the contractor, and of which the owner had notice, required guards.—District of Columbia v. Blackman (D. C.), 32 App. D. C. 32.

Notice to City of Personal Injury Is Mandatory.—The statute (Rev. St., c. 70, secs. 7, 8, Ill.) requiring notice to a city of personal injury is mandatory, and the giving of the notice required is a condition precedent to the right to sue.—Smith v. City of Chicago Heights, 141 Ill. App. 588.

Damages to Residence Property by Proximity of Electric Power Plant.

The supreme court of Texas reversed the judgment of the lower court, December 15, in the case of the Sherman Gas and Electric Company vs. Maggie P. Belden et al. The lower court had given a judgment against the Sherman Gas and Electric Company, which the court of civil appeals had affirmed, the ground being that the defendant in the lower court had erected its plant on a lot adjoining the Belden home, the damage being sought by reason of inconveniences, noise and discomfort caused by the operation of the plant. The contention was made also that the value of the property for home purposes had been reduced as much as $1,250.

An opinion, declaring that any person is entitled to certain rights, and that many businesses may be carried on next door to a residence which may not be altogether pleasant to the inhabitants of the house, but for which the owner cannot necessarily recover damages, was rendered by Associate Judge Brown. He called attention to the fact that the trial court charged the jury that if the property had been damaged and the value diminished for the purpose for which plaintiffs were using it, by reason of the operation of the defendant's plant in the manner in which it was maintained, that they should find for the plaintiff.

He held that the company was responsible only for the injury caused by the operation of its plant, and that the judge should have defined in his charge a "nuisance," and submitted that issue with instructions that if it should find a nuisance to exist, they should find for the plaintiff compensation for the discomfort and inconvenience suffered. He held that the trial court eliminated this issue and gave the jury an incorrect standard for its guidance. Judge Brown also held that the trial court erred in instructing the jury to ascertain the value of the property for the purpose to which the plaintiff had dedicated it, just before the plant was built, and such value just after the construction and operation of the plant. The opinion recites that if the property would sell for as much for any purpose after the construction of the plant as before, there could be no recovery for its reduction in value as a home.

Iowa City Debt Limits 5 Per Cent. of Real Value.

A decision rendered by Judge Smith McPherson, October 23, in the Council Bluffs, Ia., water works case, holds that the 5 per cent. limitation of indebtedness placed on Iowa cities applies to the real property valuation, and not the assessed valuation.

The assessed valuation is only one-fourth of the actual value, so 5 per cent. of the assessed valuation would mean but 1.25 per cent. of the real. Judge McPherson says:

All provisions of a constitution are mandatory. There is no such thing as a directory provision in a constitution. All paragraphs, all sections, and all words must be given full force and meaning. With these things in mind, the provision must be analyzed. When that is done we shall see that the debts heretofore created, added to the now proposed debt, shall not exceed 5 per cent. of the property, because the constitution provides that a city shall not in any manner or for any purpose go in debt beyond that limit.

But 5 per cent. of what? And how is the 5 per cent. ascertained? The first question of 5 per cent. of what is answered by the wording of the constitution, which recites: "Five per centum on the value of the taxable property within such corporation (city)." The words "value of the taxable property of the taxpayers" are what are used. It is known that exemptions from taxation are made, such as court houses, poor farms, church property, hospitals, homesteads of soldiers, etc. Such property is not to be considered, because taxable property only is to be taken into account. Of such taxable property 5 per centum is to be ascertained. But what amount? The constitution says, "5 per centum on the value of the taxable property." So that it seems clear to me that we must take 5 per centum on the value of all the property to be taxed within the city.

But how ascertained is the more difficult? That is, how are we to arrive at the value of the taxable property? Values of property for this purpose cannot be ascertained by the courts hearing evidence. One witness will say that a house and lot are worth $5,000, and one witness a larger and another witness a smaller sum. We find that the constitution requires that such valuation shall "be ascertained by the last state and county tax lists." The tax list in the first instance is made by the township or city assessor. His valuation, as noted by him and returned to the county auditor, is binding, final and conclusive, subject only to what may be called appellate proceedings by the board of review (the city council), subject further to the county board equalizing as between precincts, and the state board as between counties. But the assessor's notations, in the end, modified or not modified, go into the hands of the auditor. He takes the figures thus returned and multiplies them by the tax levies, and his figures are certified to the treasurer for collection. Practically ever since we have been a state the law has required assessments to be made at the actual value of the property. But selfishness and greed to avoid taxation by individuals, and by assessors and boards of review to assist neighbors and political friends, has resulted in a valuation of from 30 to 40 per cent. of the true value. The result has been the same as if a true valuation had been ascertained, because the levy as a multiplier has been increased as the valuation was reduced. But this evil, real or supposed, was sought to be remedied by the legislature by enacting a statute presently to be noticed.

The valuation of the property of the taxpayers on which the 5 per centum is to be computed is to be "ascertained by the last state and county tax list." What is the tax list as defined by the constitution? Section 1305 of the code is as follows:

"Valuation. All property subject to taxation shall be valued at its actual value, which shall be entered opposite each item, and shall be assessed at 25 per cent. of such actual value. Such assessed value shall be entered in a separate column opposite each item, and is to be taken and considered as the taxable value at which it shall be listed and upon which the levy shall be made. Actual value of property as used in this chapter shall mean its value in the market in the ordinary course of trade."

Herein is the pivotal question in the case. And the statement thereof, first of all, presents the inquiry whether this statute has been construed by the supreme court of the state, and whether such construction has been held to be valid or void, under the provision of the Iowa constitution limiting the indebtedness of a city to 5 per centum.

The construction given state statutes and state constitutions by the highest court of a state will ordinarily be followed by United States courts. Particularly is this so when the facts and transactions of the case have arisen since the decision of the state supreme court was made.

Therefore, waiving my own views, and properly putting all arguments to one side, it is only necessary to call attention to what the state supreme court has decided, if such construction has been given with an affirmative holding upholding similar municipal action. With this in mind, and observing this rule, in my opinion the question is put at rest by the case of Halsey vs. City of Belle Plaine, 128 Iowa 467, decided in the year 1905, three years prior to any action taken in the matter under consideration by the city of Council Bluffs.

Water Rates in Utica, N. Y., in Litigation.

A decision has been rendered in the United States circuit court at Utica, N. Y., by Judge Ray, overruling the demurrer interposed by the Consolidated Water Company of Utica, in the case of Edwin H. Risley and others vs. the city of Utica, the Consolidated Water Company and others. When the suit was first instituted the water company objected on the ground that the plaintiff was not interested to an amount large enough to give him standing in court. The court granted Mr. Risley leave to amend his complaint by adding the names of some other taxpayers, and in other particulars. The water company interposed a demurrer to the amended complaint, alleging that the complaint was multifarious and irregular generally. It also asked to have the complaint dismissed and to have set aside a stay order which restrained the controller from paying over to the company the amount of its bills for the last two years, amounting to about $85,000.

In his decision in which he overruled the demurrer and denied the motion to dissolve the injuncntion, Judge Ray says, in part:

It would seem plain that much is demanded by way of relief that could not be granted, conceding all the allegations of the bill to be true, but a demurrer does not lie to the demand for relief. Nor

is it intended to indicate that all the matters charged, if true, are the subject of relief. What is decided is that on the whole bill a case is made of equitable cognizance and of which this court has jurisdiction, and that the bill is not open to the charge of multifariousness. Several questions have been raised and discussed which the court is not called upon to determine in advance of the final hearing. It will hardly be contended, I think, that the city of Utica, by its common council, had the right to go outside the city of Utica and make improvements and expend money or contract with some corporation so to do, for the benefit of outside localities as well as Utica. * * * There should be a speedy determination of this case on the merits, and if not at issue and tried at the December term, the motion to vacate or modify the injunction may be renewed.

The effect of the decision is to try the case on its merits, and this will mean a determination of the points raised against the water works contract for the last twenty-five years. The complaint alleges that the levy of taxes which contained items for water tax under the contract deprived property owners of their property without due process of law, in that there was no authority under the law for levying the tax. The water company, it is alleged, is a monopoly to control the price of water, and the rates to private consumers are about three times the prices charged in other cities.

The bill of complaint asks that the court fix the actual value of the water company's plant in Utica and apportion the amount to be paid between the private consumers of water and the city, and that the company's income from all sources be limited to 5 per cent. on the actual value of the water company's plant. The actual value of the plant, the bill alleges, does not exceed $1,600,000. It is set forth that the water company received, in the year preceding October 31, 1908, something over $267,000 from all sources, and that the actual value of the water furnished for fire protection purposes, if sold to a single person, would be approximately $1,000, at the rate charged for water for private purposes.

WATER AND ROADS

Prevention of Stream Pollution—New Jersey Water Conservation—Bituminous Macadam for New Jersey

Practical Methods of Prohibiting Stream Pollution in Use in Germany.

The manner in which German rivers are officially guarded from being polluted by pulp factories is described by Vice Consul W. Washington Brunswick, of Chemnitz, as follows:

The pulp manufacturers are required to use every precaution possible, so that not even a particle of the waste can reach the stream. The water which is to be emptied into the river must leave the factory in an absolutely clean condition, free from any remnants from the manufacturing process. This is accomplished by sending it through one or more settling ponds, and, if necessary, the waste must be passed through filters. The streams are regularly patroled by inspectors, and any justified claims against the quality of the waters, due to pollution from the factories, is at once investigated and must be dealt with immediately, regardless of the cost. There are no regulations setting forth the exact method which a manufacturer must employ to prevent the pollution of the streams; each manufacturer can use his own ideas upon the subject as long as his method fulfills the requirements. Settling ponds are invariably used, and the results are always satisfactory. An employe of the inspection bureau of factories, who makes tours from time to time to inspect the disposition of the waste material of the factories, is under the immediate jurisdiction of the county authorities, and has charge of the licenses to the factories and of the inspection. The law is enforced to the letter, and any violation, whether unintentional or not, compels the manufacturer to pay all costs in connection with removing the pollution from the streams. A manufacturer whose works are located on one of the small streams in Saxony polluted the water, and the inspectors compelled the owner to bear all the expenses for cleaning the stream and freeing it of impurities due to his negligence. The cost of freeing the stream from pollution used up the earnings of the factory for several years.

State Water Supply Commission Is Conserving New Jersey Waters.

The State Water Supply Commission of New Jersey refused, November 30, the application of the city of Paterson for permission to construct a reservoir near Midvale for the purpose of supplying the city with water from the Wanaque watershed.

The commission announced its intention of adhering to the policy of conserving all the water supply territory possible in anticipation of future needs, granting rights only where the demand is to supply an urgent and already existing need.

Bituminous Macadam Roads for New Jersey.

In the opinion of Col. Frederick Gilkyson, state road commissioner of New Jersey, macadam is unequal to the wear and tear of automobile traffic, and the state must change its methods of construction if its roads are to be kept up to date. State Commissioner Gilkyson has reached this decision after much inquiry and many experiments, which have demonstrated that pavements superior to the ordinary asphalt may be laid in cities and suburban districts at from $1.15 to $1.50 per square yard, where they now cost $1.90 to $2.50 per square yard. The pavement referred to is bituminous macadam. The state now has eighty-five miles of bituminous pavements, and specifications have been prepared for thirteen miles more. Colonel Gilkyson is acting in connection with the federal authorities at Washington to bring about the formation of a paving commission to supervise this method of road building, thus avoiding conflicts with any of the patented compounds. In this way open bidding will be possible and the cost will be lessened.

MUNICIPAL AND TECHNICAL LITERATURE

Municipal Reports—Washington Water—Philippine Journal

Municipal Reports.

Forty-fourth Annual Report of the Board of Water Commissioners of Reading, Pa. 1907-8. Emil A. Nuebling, Superintendent and Engineer.

Progress was made on the construction of the filter plant on the portion of the supply drawn from Maiden Creek. Meantime a typhoid fever epidemic occurred, which was traced to this supply, and the water was treated for some time with copper sulphate at the rate of 1 part to 1,200,000 parts of water, which was reduced to one-third the quantity in January. A chemical and bacteriological laboratory was fitted up during the same month and some experiments on the value of hypochlorite of lime as a germicide were made. The first tests showed but little more result was obtained for any increase in quantities of the hypochlorite above one-sixteenth of a grain per gallon, and that the use of one-quarter grain per gallon on Maiden Creek water would produce the same percentage of removal of harmful bacteria as a good filter, viz., 85 to 90 per cent., and that application of materially larger quantities can be detected by the odor in the water.

The cost of cleaning the filters in use was reduced materially by improving the methods of cleaning and handling the sand.

The standard form of summary of statistics is used and the detailed tables of statistics, and of cost of operations, are more than usually satisfactory.

Nineteenth Semi-Annual Report of the Sewerage and Water Board of New Orleans, La. June 30, 1909. Geo. G. Earl, General Superintendent.

The board worked under great disadvantages during the half year covered by this report, for an attempt to sell $4,000,000 in bonds failed, and the board was required to keep its expenditures within $1,000,000, which was raised, and the special taxes, etc., amounting to about $380,000 additional. The expenditures for the half year were actually $1,301,938.62. Thus far the construction of the sewerage system has cost $4,485,412.63; the water works, $6,895,755.64, and the drainage system, $4,668,390.70. The expenses of carrying the work on have been $441,755.31 for the sewerage system, $268,825.47 for water works, $229,352.26 for drainage and $394,357.96 general purposes, and the interest paid on bonds has amounted to $1,471,410.69, so that the total cost to the city thus far has been $20,631,782.42. Bonds to the amount of $13,000,000 have been issued, for which net premiums of $494,280 were received, although the last million was sold at a discount of $60,000.

About nine miles of sewers were laid during the six months and one and three-quarter miles of water pipe. The new filter plant was put in operation February 9, 1909. About thirty-one miles of subsurface drainage lines were laid during the period of the report.

Annual Report of the City Engineer of Salt Lake City, Utah. 1908. Louis C. Kelsey, City Engineer during the year. Geo. O. Chaney, Prin. Asst. Engr., now City Engineer.

This report is one of the most extensive and most thoroughly detailed which is issued. Information taken from it will be published from time to time. Attention may be called here to some of the special features shown by the report.

One of these is the system of classification of records and accounts, whereby all the documents and references to each class of work receive the same number. Items under the contingent fund are numbered from 1 to 20, such as 2 for resurvey, 7 for health department, 13 for board of

public works, 18 for law department; water supply items are numbered from 21 to 30, water works 31 to 35, streets and sidewalks 36 to 45, sewers and drains 46 to 50. Each number has its subdivisions. Thus 2A refers to preliminary surveys, 2B to locating and setting monuments, etc.; the law department runs over the alphabet, so that case 18A3 is Foosberg versus the city, 18B3 is Wm. L. Bells versus the city, 18D3 is N. Jordan Irrigation Co. et al. versus S. Jordan Canal Co. et al., etc.; also such headings as paving, sewer, water main extensions, run by numbers instead of letters, water main extension No. 227, for example, being known as 35—227. All accounts, records, note books, maps, plats, etc., bear the same numbers, so that all can be easily gathered together when necessary.

Accompanying the classification is a new system of fire-proof filing cases in a fire-proof vault of large size, which classifies the records as correspondence; loose leaf notes from field and office, all notes being kept thus, as described in a special article in MUNICIPAL ENGINEERING, vol. xxx, p. 409; field books; drawings; photographic negatives. The records for current matters are kept in a current file, and as the file fills up and the matters pass out of immediate view, the records are moved to the permanent files, bound in pasteboard pamphlet binders and labeled. Vertical files and drawers are used according to the convenience of filing. The magnitude of the file is shown by the statement that there were on file at the beginning of this year 1,000 folders, 1,629 field books, 4,183 drawings, of which 3,125 are tracings and 1,873 photographic negatives. The characteristics of the system, which the writer had the opportunity to examine last summer, are simplicity, immediate reference and expansibility.

The city is involved in a number of suits over its various systems of water supply for domestic purposes, irrigation, and exchange, and a large part of the report is filled with detailed results of observations of rainfall, flow of water, pumpage, etc., so that the city will know at all times exactly what its water supply is and whence it comes.

Contract work in 1908 amounted to $871,704.95, as compared with $1,207,160.48 in 1907, the heaviest year the city has ever had. The proportion of the engineering expense belonging to this work amounted to 3.24 per cent. of the contract price in 1908, as compared with 2.65 per cent. in 1907, 3.45 per cent. in 1906 and 8.85 per cent. in 1905.

A Philippine Scientific Journal.

The *Philippine Journal of Science*, published at Manila, P. I., is devoted to the scientific and commercial interests of the tropics. It is published in three sections, general science ($2 a year), medical science ($3) and botany ($2), or the entire journal ($5), and seems to be issued quarterly.

Proposed Improvements of Water Supply of Washington, D. C.

The installation of a system of meters for all public and private services, and the construction of a modern coagulating plant in conjunction with the Georgetown reservoir, is advocated by Major J. J. Morrow, engineer officer in direct charge of the water service of the District of Columbia.

As a result of his preliminary investigations and surveys for increasing the water supply of the District, Major Morrow reached the following conclusions:

First—The efforts of the water department of the District of Columbia of the last three years, looking to a suppression of waste, have produced such remarkable results as to imperatively demand their continuance and extension by rapidly covering all services, both private and public, in the District of Columbia, by meters.

Second—As an alternative to providing for the construction of an additional storage reservoir, which will become more necessary as the demand for water increases, and to provide for the more efficient working of the present filtration plant during periods of excessive turbidity in Potomac water, the construction of a coagulating plant and remodeling of Georgetown reservoir for use in connection therewith is imperatively demanded as a necessary adjunct to the present system and should be at once begun.

Third—Contingent upon the adoption of these measures there can be no doubt that the consumption and waste of water in the District of Columbia in the next few years will be far enough below the safe working capacity of the existing aqueduct to make it safe to postpone new construction until fuller and more definite results are at hand to predict accurately the date at which such construction must be completed.

Fourth—There appears to be no justification for an increase in the supply through fear of failure in any of the structures of the existing system.

Fifth—When the necessity arises for an increase in the supply there appear to be three projects, any of which would give a satisfactory supply at least as great as the present, and at reasonable cost. From Great Falls an aqueduct, with all necessary appurtenant structures, could be constructed with such slight variations from plans which have been worked out in considerable detail as might be deemed necessary by advances in the art of providing public water supplies, at a cost of $3,900,000, and the work could be done in from four to five years' time, of which at least a year would be consumed in the necessary work of acquisition of title to lands necessary. On another route from Great Falls, withdrawn from the line of the existing aqueduct as far as topography will permit, an aqueduct with all appurtenant structures could be constructed at a cost of $4,350,000, and in about the same length of time.

From the Patuxent valley an aqueduct with all necessary appurtenant structures

could be constructed in from four to six years' time. Sufficient data as to cost of this development are not, however, at hand, and a known additional obstacle appears to its adoption, as the power to enter the state of Maryland for this purpose must first be obtained from that state. The project, however, offers known advantages which would justify its adoption as against the Great Falls project, even at an increased cost of nearly $1,000,000. These advantages justify a careful study at an early date, for which the sum of $3,000 should be appropriated.

Sixth—Contingent upon the construction of the coagulating plant recommended, no additional storage capacity need be provided, even when the additional conduit is constructed, nor will any addition be required to the present filtration plant beyond slight modifications in the arrangement of ducts, even with a demand for twice the present maximum consumption.

Seventh—For reasons outlined in the report of Mr. Hazen, the officials of the District of Columbia should make arrangement to cover the present filtered water reservoirs at Reno and Brightwood at as early a date as will be permitted by funds at their disposal.

ORGANIZATIONS AND INDIVIDUALS

Indiana Engineering Society—Technical Meetings—Technical Schools—Civil Service—Personal Notes

Convention of Indiana Engineering Society.

The program for the Indiana Engineering Society meeting, January 13 to 15, 1910, to be held at the Denison Hotel, Indianapolis, includes the president's address, by E. E. Watts, of Princeton; papers upon subjects pertinent to stream pollution, by Chas. C. Brown, Prof. R. L. Sackett and H. C. Jordan; illustrated paper by Prof. Malverd A. Howe, of Terre Haute, entitled "Arches: a Historic Sketch;" "Some Types of Reinforced Construction," by E. E. Watts; "Preparation of Plans for Steel Highway Bridges," by B. B. Johnson; "The Ohio River Sanitary Commission," by Hon. W. J. Wood; "The Work of the Indiana Railroad Commission," by Hon. W. J. Wood; "Deep Well System of South Bend, Ind.," by A. J. Hammond, city engineer; "A Sewer Franchise," by J. W. Fulwider; "A Proposed Telephone Franchise," by Charles Carroll Brown.

There will also be papers, titles not yet announced, by Prof. W. K. Hatt, Chas. Brossmann and C. L. Olds, and reports of committees in all the different branches of the society.

The annual banquet will be held on the 13th, at 7:30 p. m.

A prominent feature of the convention will be exhibits of articles, devices and products of interest to engineers and those connected with engineering works in rooms and corridors adjacent to the convention hall. Charles Brossmann is secretary, 43 Union Trust Building, Indianapolis, Ind.

Technical Meetings.

The American Association for International conciliation will send to members of boards of trade copies of a paper by John Ball Osborne, of the U. S. Departpartment of State, bureau of trade relations, on "The Influence of Commerce on the Promotion of International Peace."

The officers of the American Brotherhood of Cement Workers of America are F. C. Gengenbeck, president, Chicago; Henry Ulner, secretary and treasurer, San Francisco, Cal., and vice presidents from New York, Chicago, San Francisco and St. Louis.

The Illinois Association of Municipal Contractors proposes to improve the quality, quantity and efficiency of public improvements, and as a means to that end suggests to boards of local improvements early starting of the legal proceedings so that the work can be let during the winter and construction can begin early in the spring. William Howe is the executive secretary and his office is at 805 Atwood Bldg., Chicago, Ill.

The Museum of Safety and Sanitation, 29 W. 39th St., New York, has a lecture committee which is arranging a schedule of lectures for the winter which will be delivered where they are wanted if meeting place, local publicity and lantern expenses are guaranteed.

The Brooklyn Engineers' Club held its annual meeting and dinner on December 9. The officers elected were Geo. A. Orrok, president, Joseph Strachan, secretary, Wm. T. Donnelly, treasurer.

The National Association of Cement Users is making a campaign for new members and offers much of value in return for the annual dues of $5. Some of its committees are working hard upon their reports for the next convention, to be

held in Chicago, February 21-25. The committee on specifications for cement products is looking for suggestions regarding standard specifications for cement brick, tile, pipe, finish for buildings, manufactured stone and for information about thickness of joints, coloring, cement products, and defects in the adopted specifications for cement blocks. The committee on exterior treatment of concrete surfaces is also on the search for information about a larger number of details of material and workmanship on surface, methods of removal of surface and of coating surfaces, possibilities and limitations of surface in ornamental work, waterproofing, effects of blemishes and remedies therefor, specifications and costs. The list of points alone is an education in the subject.

The seventh annual dinner of the Municipal Engineers of the City of New York was held December 11 at the Hotel Savoy. At the meeting December 22 Francis L. Pruyn presented a paper on "The Reduction of the Water Table and Its Effect on Foundations in New York City."

The prizes for the ornamental centerpiece to be erected at the Chicago cement show have been awarded. The first goes to Wilbur Karl Howenstein, of Chicago, the second to Ernest V. Price, of Spokane, Wash., and the third to George Aswumb, of Chicago. The successful design is composed of a great pedestal supporting a shaft 30 feet high, which in turn supports a figure of heroic size. The four sides of the pedestal have four figures in relief representing the stone, bronze, iron and cement ages. A few spaces on the second floor only are open for new exhibitors. Those coming to the show or to any of the conventions meeting at the same time, February 18-26, should obtain certificates from the ticket agents from whom they purchase their tickets, which will entitle them to return tickets at half fare.

In addition to the business meeting, the annual meeting of the American Society of Civil Engineers will include an inspection of the works of the Pennsylvania tunnel and terminal railroad, the president's reception, another visit to the Ashokan reservoir of the new New York water supply now under construction in the Catskill mountains, an illustrated address on conservation of New York's water resources by Walter McCulloh, consulting engineer of the State Water Supply Commissioner, and an informal smoker on January 19 and 20. Charles Warren Hunt is secretary, 220 W. 57th street, New York.

The first monthly meeting of the American Society of Engineering Contractors was held in New York December 14. An Address on "The Science of Management Engineering" was delivered by H. P. Gillette. The first local section of the society will be established in Indianapolis, Ind., under a recent action of the board of directors.

The annual meeting of the Wood Preservers Association will be held in Chicago, Ill., at the Auditorium Hotel, Jan. 18, 19 and 20. Walter Buehler, St. Louis, Mo., president.

The tenth annual convention of the National Good Roads Association was held at Topeka, Kas., Dec. 14 and 15. A resolution was adopted urging the use of both convicts and enlisted men of the army in the construction of good roads; urging the construction by the national government of a system of highways connecting Washington with every state capital; endorsing the plan for a military road from Fort Leavenworth to Fort Riley; calling upon the national government to adopt a fixed policy and to make appropriations for permanent road work; urging state laws compelling the payment of poll tax in cash and providing that all moneys collected by the states from "licensing of electric, gasoline and steam driven pleasure and commercial vehicles be set aside for the improvement of state highways."

The annual meeting of the Montana Society of Engineers will be held at Butte, Mont., Jan. 6, 7 and 8. Clinton H. Moore, secretary, Butte.

The annual meeting of the Michigan Engineering Society will be held at Lansing, Mich., Jan. 12, 13 and 14. Alba L. Holmes, secretary, 574 Wealthy avenue, Grand Rapids, Mich.

The annual meeting of the Canadian Society of Civil Engineers will be held at Ottawa, Ont., Jan. 25, 26 and 27. C. H. McLeod, secretary, 413 Dorchester street, West Montreal, Que.

The convention of the Illinois Society of Engineers and Surveyors will be held at Cairo, Ill., Jan. 26, 27 and 28. E. E. R. Tratman, secretary, 1636 Monadnock Blk., Chicago.

The annual convention of the National Brick Manufacturers' Association will be held at Pittsburg, Pa., Feb. 7, 8, 9, 10, 11 and 12. T. A. Randall, secretary, Indianapolis, Ind.

The annual convention of the Connecticut Society of Civil Engineers will be held at New Haven, Conn., Feb. 8. J. Frederick Jackson, secretary, Box 1304, New Haven, Conn.

The annual meeting of the New England Association of Gas Engineers will be held at Boston, Mass., Feb. 16. N. W. Gifford, secretary, 26 Central Square, E. Boston, Mass.

The annual convention of the Iowa Engineering Society will be held at Cedar Rapids, Ia., Feb. 16 and 17. A. H. Ford, secretary, Iowa City, Ia.

The Technical Schools.

The State University of Iowa publishes the monthly, *Iowa Alumnus.*

The president's report of Cornell University with the subsidiary reports and appendices covers nearly 300 pages.

Civil Service Examinations.

The U. S. Civil Service Commission will hold civil service examinations at the usual places as follows:

Jan. 5, 6, 7: Senior draftsman in Ordnance Bureau, Washington, D. C., at $1,600 to $1,800 a year.

Jan. 12: Engineer-physicist, at $3,000 a year or associate engineer-physicist at $2,000 a year in the Bureau of Standards.

Jan. 19: Engineers in wood preservation at $1,000 and $1,300 a year in Forest Service in District No. 2, Denver, Colo.

Personal Notes.

David Barr, former mayor of Sarnia, Ontario, died in that city December 4, following a stroke of paralysis.

Dr. Ryota Hara, chief engineer of the city of Yokohoma, Japan, is visiting American cities to study their public works.

The Power Specialty Company announces the removal of its Boston office to 1031 State Mutual Building, 50 Congress street.

Anderson Polk, 32 W. 40th street, New York, is now in the railway department of the Lowe Brothers Company, paint makers at Dayton, O.

Mayor-elect Duryee, of Schenectady, N. Y., has announced his intention of appointing J. Leland Fitzgerald city engineer of that city. Mr. Fitzgerald has held the office a number of times.

William F. Morse, consulting sanitary engineer, whose specialty is the collection, treatment and disposal of municipal wastes, has opened offices in the Trinity building, 111 Broadway, New York.

E. R. Stapleton, long so favorably known in the western cement trade, is now the general sales agent of the Western States Portland Cement Co., with offices at 218 N. Y. Life building, Kansas City, Mo.

Dr. James D. McDowell, mayor-elect of Vincennes, Ind., has appointed William P. Ritterskamp a member of the board of public works; reappointed Joseph V. Hershey, city engineer; George Fendrick, chief of fire department.

James Lemon, M. Inst. C. E., has been recently knighted by King Edward VII. of England. Mr. Lemon has been prominent in the designing and construction of the public improvement work in London during his service in the various official positions he has held since entering that field many years ago.

Senor Lucas Fernandez, chief engineer for the government of Costa Rica and engineer for the municipality of San Jose, is visiting this country inspecting sewerage systems in the larger cities. Senor Fernandez is spending some time in Houston, Texas, with relatives and to attend to a number of private matters.

Mayors have been elected in Massachusetts cities and towns as follows: Holyoke, Nathan P. Avery, sixth term; Worcester, James Logan, re-elected; Chicopee, Samuel F. Fletcher; Everett, Charles Bruce, re-elected; Lynn, James R. Rich, re-elected; Melrose, Eugene H. Moore, re-elected; Newburyport, Robert E. Burke; Newton, Charles E. Hatfield, re-elected; Somerville, John M. Woods, re-elected; Woburn, Hugh D. Murray.

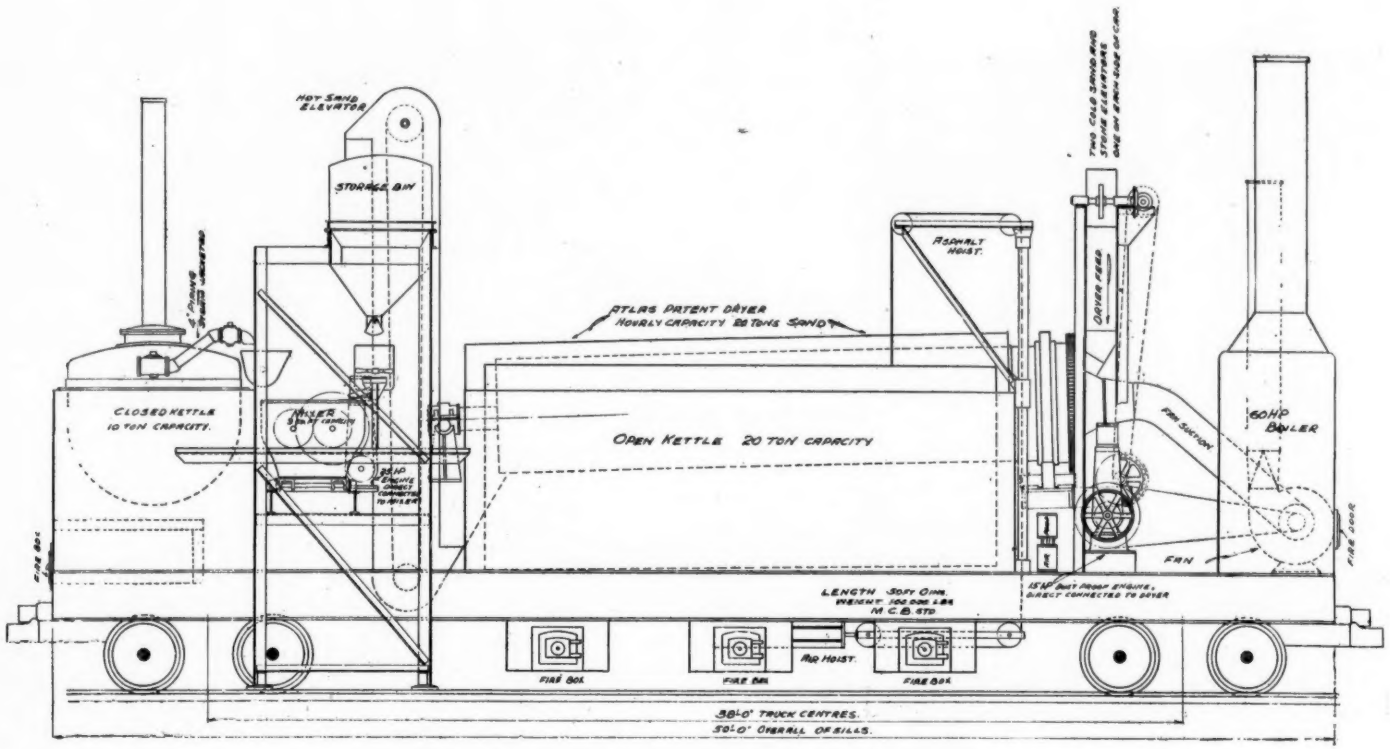
Daniel W. Church, chief assistant city engineer of Chicago, Ill., died in that city December 7. Mr. Church was first associated with the city engineer's office in Chicago in 1893, but resigned in about 18 months to take a position with the Pittsburg Bridge Company. He again rejoined the Chicago city engineering department in 1903 and served as chief assistant engineer up to the time of his death. Mr. Church was taken to the home of his family in Gouverneur, N. Y., for burial.

MACHINERY AND TRADE

Atlas Dryers and Portable Asphalt Plant.

The Atlas one-car portable asphalt paving plant has a guaranteed capacity of 1,800 yards of 2-inch topping and 4,000 yards of 1-inch binder per day of ten hours. The extreme overall length of the plant is but 50 feet and the weight less than 100,000 lbs., thus being the largest, yet smallest, and the lightest plant on the market. It can be surely called a "vest-pocket edition" of a railroad asphalt paving plant. The plant itself is up to date in every particular and strictly Atlas. It has one closed asphalt kettle, ten ton capacity, and one open asphalt melting kettle, twenty tons capacity, equipped for air agitation. Air is used for transferring asphalt from the open to the closed kettle, and from the closed kettle to the asphalt measuring bucket. There is also an air hoist for elevating asphalt to the open kettle. Westinghouse air compressor is used.

The dryer is direct driven by a self-contained, dust proof, 15 h. p. engine. The mixer, which is nine cubic feet capacity, steam jacketed, Iroquois make, is driven by direct connected 25 h. p. engine, same type as used for dryer. The boiler is 60 h. p. vertical type. There are two elevators at the feed end of the dryer—one for stone and one for sand, and a hot-sand elevator at the discharge end of the dryer for elevating the material up to the storage bin. The bin has capacity of four cubic yards of sand. The hot-sand elevator is driven from the engine, which drives the



THE ATLAS ONE-CAR PORTABLE ASHALT PAVING PLANT.

mixer, and the two cold-sand elevators and the fan are driven from the engine which drives the dryer.

The Atlas dryer on the plant makes it possible to produce such a big little plant that will deliver the product.

The sand is screened by a screen on the back end of the dryer cylinder. The screen is pushed to one side when binder is run.

The plant can be run with five ordinary laborers and one handy man, who should be a steam engineer.

An Atlas dryer can be put on any type of plant. It will double the drying capacity and not use any more space than the dryer, or dryers, it replaces. Atlas dryers dry nearly everything.

Large Vitrified Sewer Pipe.

The Blackmer & Post Pipe Co., St. Louis, Mo., issue a booklet on vitrified pipe sewers which contains some valuable information. This company has been the pioneer in large sizes of vitrified pipe and has gradually increased the maximum size from 30 to 33 and 36 inches diameter, and now undertakes the manufacture of 42-inch pipe. The demand for these large sizes has increased until the additional buildings and grounds provided in 1900 for their manufacture have become too small and enlargements are now in progress.

The only thing in the way of general use of these large sizes is the greater first cost of sewers laid with them. The pamphlet makes a very strong argument on the better value of the vitrified pipe sewer, in that it is cleaner, more durable, will not absorb or retain offensive matter, is more convenient in construction, can be laid with unskilled labor, and has less frictional resistance, so that pipes one-fifth smaller can be used, because of the greater capacity.

There is a financial argument, showing the amount which the first cost of a pipe of continuous life can exceed the first cost of pipes or sewers of certain definite lengths of life and still be equal in cost in the long run. Thus a pipe which requires no replacement can cost twice as much for first construction as one which requires replacement every 20 years. Copies of the pamphlet, giving numerous other arguments also, will be sent on application to the company.

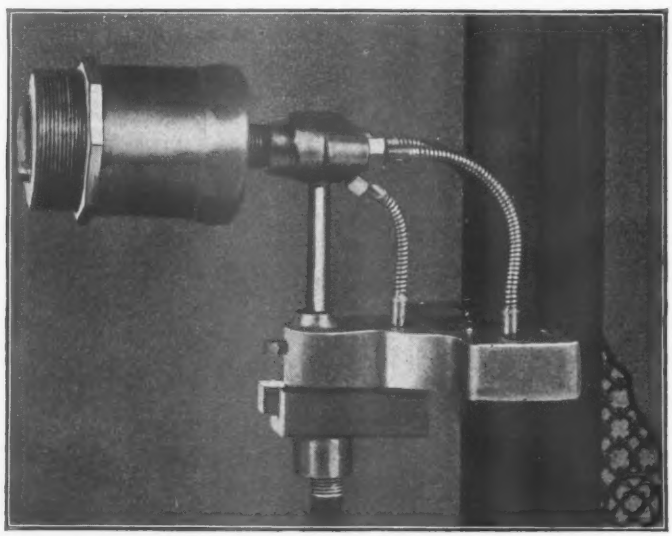
Lubricator for Elevator Guides.

The accompanying photograph shows the Imperial elevator-guide lubricator, the use of which insures a constant and automatic lubrication of elevator guides and stops the slushing of guides by hand with its loss of time and danger of accident to engineers or their assistants. Full information about the apparatus will be sent by the American Engineering and Manufacturing Company, 1215 Filbert street, Philadelphia, Pa.

Liquid Asphalt for Macadam Roads.

The Indian Refining Company, of Cincinnati, Ohio, makes two brands of liquid asphalt for use on roads, which they are putting on the market through their road preserving department. Their refineries are located at Georgetown, Ky; Lawrenceville and East St. Louis, Ill., not far from the sources from which they secure the materials.

One brand is called the 65 per cent.



IMPERIAL ELEVATOR-GUIDE LUBRICATOR.

grade, and is intended for cold surface treatment of roads already constructed. It is the outcome of several years of experience in the treating of roads. During these years, the one object of the road experts and chemists who had this work in charge, was to get material which, when applied cold to a macadam or gravel road, would penetrate into the road, bond the stone, give a smooth, dustless, mudless and resilient surface, last long enough to more than pay for itself and not pick up under traffic, injuring vehicles and clothes. Liquid asphalt is the result. In forty-eight hours of dry warm weather liquid asphalt will give these results and the road will be ready for traffic. Or, if a light coating of screenings, sharp sand or gravel is applied, about ten hours after the treatment, a still better result is obtained, and the road can be opened immediately to traffic. This treatment has lasted and is guaranteed to last for the dry season of the year in which the application is made and in a majority of cases, in the past, the road has been in a perfect condition for a much longer period of time.

The second brand is liquid asphalt binder, which contains 95 per cent. of bitumen. It is intended for new construction of bituminous macadam roads.

The company will send full information about both grades upon request.

Garbage Cremation.

Of all the methods of destroying garbage and refuse, that by fire is by far the most effective, as thus all accompanying bacteria are killed and the organic matter is completely oxidized into gases and only ashes are left behind. The destruction of garbage, or what is more correct, its reduction to ashes, in crematories, especially built for this purpose, is therefore now in almost universal use.

The design of a furnace for the burning of garbage, street sweepings, rubbish, etc., is, however, by far more difficult as it appears to one unacquainted with the problem. This is due to the ever changing composition of the materials to be destroyed and to the difficulty of securing complete combustion. Garbage, street sweepings, etc., contain a great amount of moisture, often from 30 to 72 per cent., which must be evaporated either in the process of burning or by preliminary drying, and a very high temperature and an excess of air must be maintained in the furnace at all times, as otherwise the chimney gases will be extremely offensive.

There have been put into service a number of different furnaces, most of them successful only in larger cities where the kinds of refuse are collected separately and where continuous operation can be maintained. Most of these large crematories need auxiliary fuel and with some of them a special apparatus for preliminary drying of the refuse had to be connected. Both cost of construction and cost of operation, have been very high and even for larger cities of 100,000 inhabitants and over, a garbage crematory plant up to this time has been a heavy burden. There was no furnace which met the demands of smaller cities and although the necessity of a crematory has been felt everywhere, even in the smallest country towns, the city authorities were unable to install such plant on account of its excessive cost.

The Thompson Garbage Crematory has been especially invented and designed to meet the demands of such communities, where all public improvements have to be done with utmost economy, and where the question of utilizing the waste heat in the crematory furnace for generating of steam for power plants does not arise.

The Thompson crematory is not designed to utilize the waste heat for steam generation on a large scale. The crematory is, however, provided with a water-tube grate, in which sufficient steam can be produced for driving a blower to increase the draft, if such should become necessary for certain purposes. In all ordinary cases, however, where mixed refuse is burned, natural draft alone is used, no blower or other machinery is attached, and therefore the Thompson crematory is a model of simplicity and economy.

In 1906 Mr. Jas. A. Thompson, then commissioner in charge of the water, sewerage and health department of the city of Houston, Tex., designed and installed his first crematory plant for the city of Houston, Tex., which has now been in successful operation for over three years.

This crematory is located in the center of a well built up section of the city, and has done its work without any objectionable effect. For over three years this crematory was the only method that the city of Houston used in destroying its garbage, refuse, the smaller dead animals, etc.

This plant has a capacity of about 65 cubic yards, and is sufficiently large to care for all the garbage removed from the business center of the city. No fuel is necessary for the furnace, as the lighter material is made to serve as fuel to consume the heavier substances. The smaller animals dying in the city limits are cremated here, and last summer the 563 dogs destroyed by the dog catcher were disposed of in this manner.

As a consequence of the excellent results obtained the city of Houston has now decided to replace this plant by a new Thompson crematory of a larger capacity.

In the winter of 1908-9 a Thompson crematory was built for the city of Austin, Tex., which has now been in use for some time with most satisfactory results.

Hendricks' Directory.

The eighteenth annual edition of Hendricks' Commercial Register of the United

States for Buyers and Sellers, has just been issued. It contains over 350,000 names and addresses of American manufacturers classified under 35,774 classifications, representing about every machine, material, apparatus or specialty required in the architectural engineering, mechanical, electrical, manufacturing, railroad, mine, quarrying and kindred industries, embracing everything for railroads, mines, building and construction, electrical trade, machine shops, foundries, contractors from a pick or shovel to a hoisting engine or steam shovel, agriculture, power transmission from a belt fastener to a complete system, including the latest specialties in right angle transmission and variable speed countershafts, heating and ventilating from an air valve or ventilating fan to a high or low pressure boiler, plumbing work, mill or factory, the drafting room from a drawing pencil to a blue printing machine, water supply from a water pressure gauge to a pumping engine or standpipe, municipal work from a paving brick or sewer inlet to a steam road roller, hardware, iron, steel and other metals, machinery, over 2,700 classifications of as many different kinds. S. E. Hendricks Co. are the publishers, 74 Lafayette street, New York City, and the price is $10.

How to Clean Deep Wells.

In the operation of deep wells for municipal, manufacturing or private use, a great deal of trouble, annoyance and expense is invariably encountered by the choking up of the well strainers, and loss of efficiency caused by the pumping of large quantities of air drawn through the open top of well and passing down into pump chamber.

The Clark well construction obviates these troubles and brings with it satisfaction and increased well capacity at greatly reduced cost; eliminating dangers of contamination, as surface waters, foul air and other impurities are prevented from entering well. This well construction is adapted for use on any kind of a well, and in connection with any kind of pumping head, direct steam power, geared or belted, or hand power.

The entire top of well is hermetically sealed, thus permitting by the operation of pump the formation of a vacuum extending to the bottom of the well and greatly increasing the draft or suction on the water bearing stratum. The vacuum formed is indicated on a vacuum gage.

By this equipment the capacity of wells has in some instances been increased 100 per cent., affording double the quantity of water, of greatly improved quality.

The vacuum gage forms a reliable and convenient tell-tale of the condition and efficiency of the pump at all times; as, knowing what the vacuum point should be under different conditions, a lowering therefrom is conclusive evidence of worn or leaky pump valves or packings.

On the discharge line from the pump there is placed a check valve and a pressure indicating gage. The discharge line is cross-connected onto the outside casing of the well.

By the operation of a gate valve a flow of water under pressure may be turned into the well casing and forced through the slots of the strainer at the bottom of the well, thus thoroughly forcing accumulated fine sand away from and thoroughly cleaning the strainer.

A pipe connection with small stop cock is placed at the extreme bottom of cleaning pipe, for the purpose of determining at any and all times whether there is a leakage of water past the gate valve.

Another pipe line connection is made on the cleaning line for the introduction of compressed air or steam under heavy pressure into well casing for cleaning purposes, where it is desired to so do.

This well construction is supplied by the H. W. Clark Co., Mattoon, Ill., the manufacturers of the well-known Clark meter box.

Trade Publications.

The H. W. Johns-Manville Co. publishes a brief illustrated description of "How 4 Cars of Coal Did the Work of 5."

The Christmas greeting of the H. Mueller Mfg. Co., Decatur, Ill., is deserving of special mention because it steps out of the line of trade and impresses upon the receiver a feeling of personal interest which is very grateful.

A preliminary discussion on creosoted wood block pavement by C. Marshall Taylor, in charge of the department of chemistry and tests, is issued in pamphlet form by the International Creosoting and Construction Co., which compares the specifications for blocks and oil now in use and presents the specifications used by this company.

The Universal Portland Cement Company's circular No. 67 has many photographs of ornamental and useful applications of cement in construction.

The Indianapolis office of the Lehigh Portland Cement Co. publishes a booklet on "The Modern Farmer," which shows many structures for farm use, made of cement, and tells how to make many of them. F. E. Paulson is the moving spirit in this office.

The Weber-Duller Co., 329 Commercial Bank Bldg., Houston, Tex., issue a booklet on "Economical Garbage Disposal and the Thompson Garbage Crematory."

A circular concerning the American Exposition to be held in Berlin, Germany, in June, July and August, 1910, has been received from the American Headquarters, 50 Church street, New York City.

The Power Specialty Co., 111 Broadway, New York, issue a handsomely illustrated catalog of the Foster patent superheater, showing it in all its details and giving photographs of many kinds of installations

with all sort of boilers and furnaces. It is one of the most satisfactory booklets of its kind because it is so complete and detailed and at the same time so brief.

Calendars, wall and desk reminders have been received from the following: Deckman-Duty Brick Co.. Cleveland, Collinwood, Carrollton, and Malvern, O.; Universal Portland Cement Co., Chicago, Ill., and Pittsburg, Pa.; the Springfield Republican, Springfield, Mass.

A. S. Aloe Co.'s catalog of mathematical and engineering instruments and drawing materials has been received from St. Louis, Mo.

Trade Notes.

ASPHALT.

Pittsburg, Pa.—Press reports of Dec. 13 state that as soon as plans have been prepared for the proposed new asphalt plant, the city will take possession of the Peabody site in Homewood, for the acquisition of which condemnation proceedings have been entered.

The Atlas Dryer Company, of Cleveland, Ohio, has just received an order from The Newell Quarry Company, of Cleveland, Ohio, for one of its Atlas dryers, self-contained type, with Atlas mechanical stoker, for burning slack bituminous coal, the dryer to be used for drying silica sand, capacity 150 tons per day of ten hours.

The Atlas Dryer Company, Cleveland, Ohio, reports that it has just shipped one of its Atlas dryers, self-contained type and completely erected, to the Metropolitan Construction Company, Wichita, Kan. The dryer is to replace a dryer of another make, that did not have sufficient capacity, on a portable asphalt paving plant. The first order from the Metropolitan Construction Company was for an Atlas one-car portlable asphalt paving plant.

Fort Smith, Ark.—The Fort Smith Vitrified Brick Co. has been awarded a contract for supplying the Prairie Oil & Gas Co. with 1,000,000 brick for use in building pipe lines and pumping stations at Kinta, Okla., and DeQueen, Ark.

The Corry Brick and Tile Co., Corry, Pa., has installed one of Frank B. Dunn's machines for wire cutting lug brick, and reports that it works to perfection. The invention only needs to become well known to induce the general use of paving brick made in this manner without repressing.

BRICK.

Spokane, Wash.—Contracts will be let soon for constructing a steel and concrete plant for the People's Portland Cement Company, recently incorporated, at Squaw Bay on Lake Pend d'Oreille, 60 mis. northeast of Spokane. Arthur S. Ford, of New York City, and H. A. Groth, of Chicago, are interested in the proposed letting of the contracts.

Wayland, N. Y.—The Wayland Portland Cement Co. has purchased the cement works of the Thomas Millen Company, of Syracuse, N. Y., which has been operated in this city for the last 16 years. The Wayland Portland Cement Co. was organized by local business men, consisting of John Kimmel, F. K. Smith, F. C. Lander, H. V. Pratt and O. F. Kiefer, with officers as follows: President, John Kemmel; vice-president, F. K. Smith; treasurer, F. C. Lander; secretary and treasurer, O. F. Kiefer.

Rockland, Me.—The New England Portland Cement Co. contemplates the erection of cement manufacturing plant during 1910.

Evansville, Pa.—The Allentown Portland Cement Co. is erecting a plant here.

CONCRETE BLOCKS.

Hayden, Colo.—The Hayden Concrete Co. has been incorporated by David Flitner, T. Shelton and John E. Miles.

Jersey City, N. J.—The Marshall Concrete Construction Co. has been incorporated to manufacture concrete materials and ingredients, building materials, etc. Wm. Hutchinson is interested.

Washington, D. C.—The Southern Concrete Products Co. has been incorporated to manufacture and sell concrete and similar products, by Wm. A. Kennedy, Chas. H. Galliher, Clarence T. Kingsbury, Frank L. Averill and Fred Drew, all of this city.

PURCHASE OF MACHINERY.

Chicago, Ill.—(Special). The F. G. Lewis Mfg. Co., 1170 S. Robey st., advises us that it desires the names of firms who make kettles, dippers, buckets, etc., such as are used by paving contractors.

Portland, Ore.—(Special). P. Melhuish, care Warren Construction Co., is in the market for all equipment connected with road making.

Daytona, Fla.—(Special). D. D. Rogers, cy. engr., is in the market for a lightweight mountain transit.

Portland, Ore.—(Special). P. Melhuish, care Warren Construction Co., is in the market for dust preventives.

Williamston, S. C.—(Special). E. C. Horton is in the market for drain pipe for crossings, etc.

LIGHT, HEAT AND POWER.

Oklahoma City, Okla.—The Oklahoma Gas Engine Co. has been incorporated by A. Fishback, J. Worthington, W. F. Thor, F. Kabat, of this city, and W. G. Clark, G. Lowe, T. Clark, G. Clark, D. Clark and T. Lowe.

Oklahoma City, Okla.—The Union Gas & Electric Co. has been incorporated by F. L. Brandiger, C. W. Stephenson and F. D. Brown.

Champaign, Ill.—The Terminal Power Co., of McKinley, has been incorporated to produce and distribute electricity, gas, water, steam and hot water, by George W. Mattis, W. H. Carnahan and B. E. Bramble.

Decatur, Ill.—The Progressive Light & Power Co. has been incorporated to manufacture and sell electric current for power and lighting purposes, electricity and gas for heating, gas for illuminating, heating and power purposes, etc., by W. H. Suffern, Robert I. Hunt and Fred M. Ives.

Mt. Hope, W. Va.—The Varner Co. has been incorporated to build electric light and power plants, by J. F. Garrett and P. M. Snyder, of Mt. Hope; Alex. McNabb, J. W. Smiley and Samuel Dixon, of MacDonald, W. Va.

MISCELLANEOUS.

Milwaukee, Wis.—The Milwaukee Concrete Mixer Machinery Co. has been incorporated by W. J. Roseberry, R. J. Schwab and Henry E. Schwab.

Dundas, Ont.—Plans for a 4,000-ton crusher plant have been prepared for Doolittle & Wilcox. It will be erected on their property west of this city.

Cedar Rapids, Ia.—The Universal Crusher Co. has been incorporated by D. B. Getty, Jos. Cockfield, E. A. Velde, F.

F. Dawley and C. E. Wheeler, all of this city.

Moline, Ill.—W. L. Velie, of this city, has purchased a large stone crusher of the Austin-Western Co., of Chicago.

Normal, Ill.—This city has purchased a street sprinkler and sweeper of the Studebaker Mfg. Co., of South Bend.

Citico, Ala.—The Citico Furnace Co. has installed a No. 6 stone crusher, which was purchased of the Austin-Western Co., of Chicago.

Pacomai, Cal.—The Austin-Western Co., of Chicago, has sold a crushing plant to the Pacomai quarry.

Cedar Rapids, Ia.—The contract for crushers and other machinery for the new plant to be erected at Garrison, Ia., by the American Crushed Stone Co., was awarded to the Austin-Western Co., of Chicago. The new concern is composed of business men of this city.

Alexandria, La.—A. Wyckoff & Son Co. have established a wooden water pipe factory for the purpose of using the cypress lumber, so abundant in this region, in the manufacture of their water pipe for heads up to 200 pounds per square inch.

SEWER PIPE.

Indianapolis, Ind.—The William E. Dee Clay Co., of Illinois, has been incorporated here to manufacture, buy and sell and generally to handle and deal in sewer pipe, flue linings, drain tiles, etc., by Wm. E. Dee, L. B. Sauter and Ed G. Henkel.

Portland, Ore.—The Glazed Cement Sewer Pipe Co. has awarded a contract for the erection of a manufacturing plant in Kenton.

Rome, Ga.—The Standard Sewer Pipe Co., which was organized by D. B. Hamilton, Jr., and C. C. Harper, has purchased the plant of the Morrison-Trammell Brick Co., and will manufacture sewer pipe. New machinery will be installed.

New York City.—The annual meeting of the Sewer Pipe Distributers was held at the Hotel Astor, December 13. On account of ill health Arthur N. Pierson declined re-election as president, and Jas. G. Lincoln, of Boston, was chosen to fill the office. E. S. Walton, of Youngstown, O., was elected vice president; J. C. Adams, of Pittsburg, secretary and treasurer.

Patents on Concrete in Railway Track Construction.

906,067. Railway Tie. Hugh H. Ranje, Indianapolis, Ind.

906,686. Reinforced Concrete Railway Sleeper. Maurice Bruckner, Budapest, Austria-Hungary.

908,765, 908,766. Reinforced Concrete Track Ties. Wm. Gabriel, Detroit, Mich.

909,378. Reinforced Concrete Tie. Wm. Dunson, Indianapolis, Ind.

910,559. Railway. John J. Martin, Los Angeles, Cal.

911,734. Reinforced Concrete Sleeper for Railways and Tramways. Gaston Liebeaux, Nantes, and Francois Hennebique, Paris, France.

912,219. Reinforced Concrete Structure (railway track). Linn White, Chicago, Ill.

912,227. Reinforced Concrete Railway Sleeper. Maurice Bruckner, Budapest, Austria-Hungary.

912,663. Concrete Tie. Niels P. Frandsen, Chicago, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Aurora, Ill.—The finance committee estimates that $298,920.30 will be needed to operate this municipality during 1910.

Peoria, Ill.—The report of Col. John Warner, superintendent of sidewalks, has been filed with the commissioner of public works, and it shows that during the present year about 70,000 lin. ft. of cement sidewalks have been laid.

Port Huron, Mich.—The hearing of the injunction petition of the State of Michigan vs. The Clyde Plank and Macadamized Road Co., which was set for Dec. 20, was continued to Dec. 29. The bill of complaint alleges that the defendant company has failed to keep its road in repair as required by statute. The defendant claims the circuit court has no jurisdiction in the case, and this is the point to be settled.

CONTEMPLATED WORK.

Hoquiam, Wash.—The city council will expend $90,000 in street improvements.

Pella, Ia.—The question of paving is being agitated here.

Atchison, Kans.—A resolution has been passed for paving Green st.

Trenton, N. J.—An ordinance has been passed for paving Olden ave.

Seward, Neb.—Council has decided to pave the streets around the public square.

Osage, Ia.—The city council has decided to pave 8 blocks of Main st. with concrete.

Richmond, Va.—This city has appropriated $50,000 for paving Franklin st. Address mayor.

Carmi, Ill.—Special.—Claude M. Barnes says 2 mls. of brick paving will be constructed.

Platteville, Wis.—Brick paving is contemplated next spring for Main st., from Court to Water sts.

East Moline, Ill.—Brick paving is contemplated for the bluff road, from 12th st. to Warner's Crossing.

Mitchell, S. D.—The question of paving the main street of this city is being urged by the business men.

Ames, Ia.—The city council has appointed a committee to investigate the matter of paving for this town.

Indianapolis, Ind.—A resolution has been passed providing for the paving of a portion of Washington boulevard.

Green Bay, Wis.—The estimated cost of paving contemplated during 1910 is $220,000. W. W. Reed, cy. engr.

Mason City, Ia.—Council will take final action, Jan. 10, for improving the alley in block 25, Paul Filt's plat.

Riverside, Ill.—Plans and specifications will be prepared for constructing paving, sewer and water improvements.

Onamia, Minn.—The question of issuing bonds for constructing roads in the town of Kathio is being discussed.

Pensacola, Fla.—Bids have been authorized for paving Paloff and Tarragona sts. L. E. Thornton, cy. engr.

Portsmouth, Va.—This city contemplates expending $200,000 for street paving during 1910. Bascom Sykes, cy. engr.

Saginaw, West Side, Mich.—About $142,000 is to be expended on road improvements in this county during 1910.

Springfield, Mass.—City engineer Farnham is preparing plans for the preliminary work for paving Allen, School and Dunham sts.

Creston, Ia.—Final action will be taken, Jan. 4, on the matter of paving several streets with asphaltic macadam, with concrete curbing.

Cincinnati, O.—J. N. Sundmaker, cy. engr., estimates the cost of brick paving in Rottermann and Lischer aves. at $14,487 and $9,992, respectively.

Akron, O.—Estimates have been submitted for road improvements as follows: Arlington st., brick, 317,343; Brittain road, brick, 319,393.

Beloit, Wis.—This city contemplates constructing 50,000 sq. yds. of brick, macadam and creosoted block paving. Robt. Caldwell, cy. engr.

Salina, Kans.—Special.—P. G. Wakenhut, cy. engr., advises us that W. Ash st. and the south end of Santa Fe ave. will be paved this year.

Abilene, Tex.—This city voted, Dec. 18, to issue $50,000 bonds for street improvements. Work in the downtown streets will begin early in 1910.

Prospect Park, Pa.—An ordinance has been passed providing $15,000 for macadamizing all streets in this town in which sewers have been laid.

Colorado Springs, Colo.—The question of paving the streets is under discussion and the various paving materials are being investigated.

Des Moines, Ia.—A petition has been submitted council asking for taroid macadam paving on 35th st., between Gravel ave. and Kingman boulevard.

Long Beach, Cal.—This city has authorized the grading, paving and curbing of Esperanza, Falcon, Gaviotta and Hermosa aves. F. L. Craig, prest. B. P. W.

La Crosse, Wis.—The bd. of pub. works has decided to pave 3 blocks of streets with brick, 11 blocks with asphalt, and construct curbing and gutters.

Little Rock, Ark.—Asphalt paving on concrete foundation, with brick gutters, is contemplated in the Louisiana st. district. E. A. Kingsley, supt. pub. wks.

Hastings, Neb.—Council has received a petition asking for paving in St. Joe and Hastings aves. and the blocks to the north, east and west sides of the court house.

Beaumont, Tex.—The special committee of the Jefferson County Good Roads Association has recommended the issue of $100,000 bonds for further road work in this county.

Crawfordsville, Ind.—Resolutions have been passed for paving College and Water sts. with asphalt, wooden cedar blocks, brick or bitulithic. H. B. Hulett, cy. clk.

Phoenix, Ariz.—The construction of a 6-in. crushed rock, oiled roadway in Central ave. is contemplated, at a cost of about $30,000. Major E. M. Laurson, secy. special road dist. No. 1.

Oconomowoc, Wis.—A resolution has been adopted providing for the paving of Milwaukee and N. Main sts. with permanent pavement on concrete base, with Portland cement curbs and gutters.

Rock Island, Ill.—A petition has been submitted to the board of local improvements asking that 3rd ave. be paved with asphalt, to replace the present brick paving, which is in bad shape.

Jacksonville, Ill.—A contract will be let about April 1 for about 14,000 sq. yds. of asphalt paving in Prairie st., with 9,900 ft. of combined curb and gutter. C. W. Brown, engr.

Peoria, Ill.—The property owners in Adams st. are in favor of asphalt paving, and the bd. of supervisors favor brick paving. The city engineer has been directed to prepare estimates for paving Charles st. with brick.

Norman, Okla.—The city council has decided to pave 50 blocks of streets and will ask for bids for rock asphalt and petrolithic pavement. The council will spend the time until time for receiving the bids investigating the new pavement.

Mobile, Ala.—Estimates have been approved and bids will be asked soon for paving Water st. with concrete. Estimates will be prepared for paving, guttering and draining Spring Hill and Davis aves. and Broad st. Wright Smith, engr.

East Palestine, O.—Special.—C. E. Vaughn, surveyor and civil engineer, advises us that ordinances have been passed for paving 11,400 ft. of Clark and Martin sts. with brick or block, and the contracts will be let in the spring.

Beeville, Tex.—The city council has decided to employ Terrell Bartlett, C. E., of San Antonio, to make surveys of the entire city, establish grades, etc., with a view to extensive street lighting and the construction of a sewer system.

Freeport, Ill.—The street improvements for 1910 will probably include the following: Adams and Williams sts., 1 mi. of brick; Union st. and Deiter and Pleasant Park aves., 2-3 mi. of brick; Jefferson, High, Float and Rotzler sts., 2-3 mi. of macadam or brick; Douglas ave. and Powell st., ¼ mi. macadam or brick; Whistler st., 2 blocks of brick. The contracts will be let in March. John A. R. Daniels, cy. engr.

CONTRACTS TO BE LET.

Shenandoah, Ia.—Bids are asked until Jan. 3 for paving Valley ave. Council.

Ft. Worth, Tex.—Bids are asked until Jan. 5 for paving Lipscomb st., from Terrell ave. to Capps st.

Ft. Leavenworth, Kans.—Bids are asked until Jan. 8 for grading 84,000 cu. yds. of earth. Capt. Wm. D. Davis, Q. M.

Jacksonville, Fla.—Bids are asked until Jan. 5 for resurfacing about 25 mis. of county roads. Gail L. Barnard, co. engr.

Little Rock, Ark.—Bids are asked until Jan. 18 for paving in the East 2nd st. improvement district. E. A. Kingsley, supt. pub. wks.

New Rochelle, N. Y.—Bids are asked until Jan. 6 for constructing curbs, gutters and sidewalks in Mayflower ave. Richard Lathers, Jr., chmn. B. P. W.

Cincinnati, O.—Bids are asked until Jan. 7 for improving Stone Mill road, from Colerain pike, at Dunlap, to county line. Fred Dreitis, clk. bd. co. comrs.

Lenoir, N. C.—Sealed bids are asked until Jan. 5 for macadamizing about 3 mis. of road near here and 3 mis. of additional road to be graded by the Lenois & Blow-

ing Rock Turnpike Co. R. L. Gwyn, secy. or treas. of company; C. M. Miller, engr., Salisbury, N. C.

Ada, Okla.—Bids are asked until Jan. 3 for 38,680 sq. yds. of paving, using Oklahoma rock asphalt on 5-in. Portland cement concrete base. P. G. Eckman, cy. engr.

Elk City, Okla.—Bids are asked until Jan. 10 for constructing 20 blocks of vitrified block paving, including grading, storm sewer, curbing, gutters, etc. R. L. Carlisle, cy. clk.

Ottumwa, Ia.—Bids are asked until Jan. 3 for 16,000 sq. yds. brick paving on concrete base, 1,200 sq. yds. of creosoted block paving and 10,000 lin. ft. cement curb. J. T. Brady, cy. engr.

New York City.—Bids are asked until Jan. 4 for furnishing cement, sand and broken stone, and for furnishing and putting in place small cobble and riprap stone. Allen N. Spooner, comr. docks and ferries.

New Berne, N. C.—Bids are asked until Jan. 4 for constructing about 48,000 sq. yds. of brick paving, with cement filler; brick, with sand filler; bitulithic and asphalt macadam; all or part to be made in either kind of pavement. F. T. Patterson, cy. clk.

CONTRACTS AWARDED.

San Diego, Cal.—The contract for improving 17th st. was awarded to M. D. Goodbody for $7,989.51.

San Bernardino, Cal.—B. F. Ford & Co. were awarded the contract for macadamizing D st., for $25,514.

South Bend, Ind.—The contract for paving N. Eddy st. with asphalt macadam was awarded to C. H. Defrees, Dec. 8.

Long Beach, Cal.—White & Gaskell, of this city, secured the contract for 206,000 sq. ft. of paving, for $11,500.

Tacoma, Wash.—The Barber Asphalt Paving Co. was awarded the contract, Dec. 11, for $98,671.

Trenton, N. J.—The contract for resurfacing Chambers st. with Warrenite was awarded to the United Paving Co. for $6,700.

Red Bank, N. J.—The contract for paving Front st. was awarded to Charles E. Burd, of this city, at $2.35 a cu. yd.

Bellaire, O.—The contract for paving the Bellaire and Rhodyside pike was awarded to W. J. Berry, of Powhatan, for $25,000.

Hubbard, O.—The contract for constructing sidewalks in E. Liberty st. was awarded to F. L. Keys.

St. Joseph, Wis.—The contract for paving Francis st. with asphalt was awarded to the Metropolitan Construction Co. at $1.55 a sq. yd.

Jennings, La.—The contract for constructing 7 or 8 mis. of cement sidewalk was awarded to De Jersey & Bernard, of Minden, La., for $30,000.

Prescott, Ariz.—Sines & Rockmark secured the contract for constructing a 6-in. crushed rock, oiled roadway in Central ave., for about $30,000.

Eaglewood, N. J.—Edward English was awarded the contract for constructing a concrete sidewalk and macadamizing West End ave., for $7,500.

Piper City, Ill.—The contract for paving the streets was awarded, Dec. 23, to Contractor Finley, of Hoopeston, Ill., for $14,780.

Houston, Tex.—The contract for paving Washington ave., San Jacinto and Travis sts. with brick was awarded to A. T. Lucas, for $31,988.

Houston, Tex.—The contract for grading the Houston and Clodine road for a distance of about ½ mi. was awarded to Sunderman & Dobson, at 12¾ cts. a cu. yd.

Pulaski, Va.—The lowest bid submitted Dec. 11 for constructing 2.6 mis. of road in Pulaski county was by Warden, Hattel & Co., of this city, for $12,785.

Vicksburg, Miss.—The bids submitted Dec. 6 for paving a number of streets with vitrified brick, granitoid, bitulithic, asphalt, mineral rubber and creosoted wooden blocks were returned unopened.

New Orleans, La.—The Metropolitan Construction Co. was awarded the contract for paving with Sarco for $207,724.92, and James A. Craven Co. the contract for square granite block paving in Julia st. for $5,810.20.

Arkansas City, Ark.—Special.—The contract for paving Chestnut ave. and 6 alleys with paving blocks, on 6-in. concrete base and asphalt filler, was awarded to Rushmore & Gouty, of Cherryvale, Kans., at $1.53 a sq. yd.

Asheville, N. C.—The contract for macadamizing Spring st. was awarded to the French Broad Quarry Co. for $7,235. B. J. Luther & Co. were awarded the contract for constructing a boulevard through the property of the Kenilworth Land Co.

Atlantic City, N. J.—The contract for constructing the Chelsea board walk between Texas and Albany aves. was awarded to Wilbert Beaumont, of this city, for $18,627. The walk will consist of a concrete substructure, with wooden decking.

Akron, O.—Bids were submitted Dec. 14 for street and sewer improvements, as follows: Valley st. paving, from Crosby to Silver sts., Hunt & Wigley, $5,684; Dan O'Marr, $5,656; Wildes & Davidson, $3,439; McAntonan Bros., $6,147; John O'Neil, $5,866. John T. Payne is city engr.

New York City.—The contract for repaving Bement ave. and other streets with vitrified brick was awarded to Joseph Johnson's Sons, 193 Broadway, West New Brighton, S. I., for $7,127. The Asphalt Construction Co. was awarded the contract for repaving with asphalt blocks on concrete, Park ave., East, for $12,038, and the Asphalt Construction Co. the contract for repaving a number of streets with old granite blocks, for $82,131.

Columbus, O.—Contracts for improving 16 streets and constructing 3 sewers were awarded as follows: J. C. Beasley, Detroit ave., at $1,848; Budd & Bartling, Columbus, have the contract to pave Duxbury ave. with Athens block at $3,685, also to pave Wilco ave. with the same material for $2,454; W. H. Graham secured the contract to pave Elm st. with Athens block and tar filler, at $1,285, also to pave Morrill ave. with Peebles brick, at $2,412; H. J. Shaw, Columbus Savings & Trust Bldg., was given the contract to pave 5th ave. with Athens block, one section for $3,656 and the other section for $6,885; H. E. Barthman was awarded the contract to pave Locust st. with Athens block, for $1,371; Geigle & Garnes, Columbus, were let the contract to pave Mink st. with Athens block, for $2,043; A. G. Pugh was given the contract to pave 22nd st. with California asphalt, at $8,067; H. J. Shaw was given the contract to pave Price st. with Metropolitan block, for $8,460.

SEWERS.

Victor, Colo.—The city council passed an ordinance, Dec. 10, revoking the franchise of the Victor Sewer Co., and declared that the plant of this company should become the property of the city upon the payment of its fiscal value, which is estimated at $73,000.

CONTEMPLATED WORK.

Essex, Ia.—A sewerage system is contemplated.

Canby, Minn.—Plans have been prepared for a sewer system.

Allentown, Pa.—The need of a sewerage system in this city is being urged.

Imperial, Cal.—Voted to issue $40,000 bonds for constructing a new sewerage system.

Huron, S. D.—Council has decided to construct a sewer in Frank st.

Montevideo, Minn.—Council has adopted plans for sewers in 5th st. and Miawaukee ave.

Yoakum, Tex.—The question of a modern sewerage system here is urged. Mayor Price.

Hoquiam, Wash.—Specifications have been completed for constructing a trunk sewer.

Beaumont, Tex.—Will vote, Jan. 14, on the issue of $150,000 for drainage improvements.

Osakis, Minn.—Special.—T. H. Borchus says a septic tank for the sewerage system is contemplated.

Colton, Cal.—Voted to issue bonds for constructing a sewerage system. W. L. Brown, co. engr.

Belle Plaine, Ia.—Council has ordered a survey made for a sewer outlet, septic tank, etc.

Glendale, O.—Will vote, Jan. 25, on the issue of $75,000 bonds for constructing a sewerage system.

Stoughton, Wis.—Plans for a complete sewerage system have been prepared by Z. T. Hurd, cy. engr.

West Dundee, Ill.—The establishment of a sanitary sewer district is proposed. Mayor Shedden.

Lewistown, Ill.—The contract will probably be let about Feb. 1 for constructing sanitary sewers.

Ft. Smith, Ark.—The report of Samuel M. Gray, of Providence, R. I., on the sewerage system has been submitted.

Colorado Springs, Colo.—City Engr. Waggener estimates the cost of building the proposed storm sewers at $50,000 to $60,000.

Corsicana, Tex.—An ordinance has been passed authorizing the issue of $20,000 bonds to extend the sewerage system.

Palestine, Tex.—The city commissioners are considering the construction of 15,000 additional feet of pipe sewers.

Savannah, Ga.—Will probably vote in February on issue of bonds for extension of sewerage system. J. W. Howard, cy. engr.

Sandusky, O.—Plans have been prepared for rebuilding 2,500 ft. of 10, 12 and 15-in. sewer in Franklin st. C. M. King, cy. engr.

Houston, Tex.—Plans and specifications have been completed by F. L. Dormant for sanitary sewers in the 2nd and 3rd wards.

Macon, Ga.—Voted Dec. 8 to issue $400,000 bonds for constructing a sanitary sewerage system and paving in Vineville.

Maplewood, N. J.—Ordinances have been passed for constructing sewers in South Orange twp. Edward R. Arcularius, twp. clk.

Beeville, Tex.—The city council has engaged Terrell Bartlett, of San Antonio, to make surveys of the entire city, with a view of constructing a sewerage system.

McKeesport, Pa.—Messrs. Duncan, Johnston and Block have been appointed a committee to employ assistants for the city engineer to prepare sewer plans.

Lebanon, Pa.—Will vote in February on issue of $115,000 bonds for constructing a comprehensive sewerage system and enlarging three natural waterways within the city limits.

Greenfield, Mass.—The sewer committee has decided to recommend the construction of an intercepting sewer to prevent the present pollution of Green river. Geo. F. Merrill, chmn.

La Crosse, Wis.—The bd. of pub. wks. has decided to construct a sedimentation basin at the foot of Pine st. and a main in Pine st., at a cost of $190,000, and sewer construction at cost of about $10,000.

Ely, Nev.—Special.—Alfred B. Colwell, cy. engr., has been authorized to retain the services of Alexander Potter, consulting engineer of New York City, in connection with the designing of a sewage disposal plant for this city. The plant will be constructed in the opening of 1910.

New York City.—Special.—M. T. Richardson, P. O. Box 654, desires to communicate with mnfrs. of a distributing apparatus for sewage systems, where a half dozen beds are prepared and the sewage is conducted to each bed in rotation, giving each bed an opportunity to rest for six days.

CONTRACTS TO BE LET.

Prince Rupert, B. C.—Bids are asked until Jan. 19 for installing sewage wks. Dept. Pub. Wks.

Sapulpa, Okla.—Bids are asked until Jan. 10 for constructing a brick trunk sewer. Ira J. Anderson, cy. clk.

Lawrence, Kans.—Sealed bids are asked until 5 p. m., Jan. 3, for constructing lateral sewers. F. L. Brooks, cy. clk.

Meadville, Pa.—Bids are asked until 8 p. m., Jan. 5, for constructing a sewer in Grove st. H. S. Robinson, cy. clk.

Marion, Ind.—Bids are asked until Jan. 8 for constructing the Clement I. Coble ditch. D. M. Murphy, impvt. comr.

St. Paul, Minn.—Bids are asked until Jan. 6 for constructing 4 state ditches. Geo. A. Ralph, engr. State Drainage Com.

Columbia, Mo.—Bids will probably be asked about Jan. 15 for constructing pipe sewers. John S. Bicknell, cy. clk.

Muskegon, Mich.—Bids are asked until Jan. 28 for constructing sewers in sewer dist. No. 7. Benjamin H. Tellman, cy. recdr.

Holton, Kans.—Bids are asked until Jan. 12 for constructing a sewerage system and disposal plant. G. H. Merrill, cy. clk.

Batavia, N. Y.—Bids are asked until Jan. 5 for constructing a sewage well at the municipal plant. Bd. sewer comrs.

Charleston, S. C.—Bids are asked until Jan. 11 for constructing pipe sewers and appurtenances. J. H. Dingler, cy. engr.

San Francisco, Cal.—Bids are asked until Jan. 5 for constructing sewers in secs. A, B, C, D and E, Yerba Buena district. B. P. W.

Hebron, Neb.—Bids are asked until Jan. 12 for constructing 13,000 ft. of lateral sewers, 12 flush tanks, 25 manholes, etc. O. P. Hees, cy. clk.

Denver, Colo.—Bids are asked until Jan. 14 for constructing district sewers, submains and other appurtenances in West South Side sanitary sewer district. B. P. W.

Detroit, Mich.—Bids are asked until Jan. 5 for furnishing and erecting machinery for a sewage pumping station at the foot of Parkview ave. Jacob J. Haarer, comr.

Toronto, Ont.—Bids are asked until Feb. 15 for constructing sewer outlet, sewage tanks and supply of steel, c. i. pipe, sludge valves, etc. Joseph Oliver, mayor.

CONTRACTS AWARDED.

Oklahoma City, Okla.—Bouse & Bouse secured the contract for constructing sewers for $67,973.50.

Springfield, Ill.—The contract for constructing sewers in certain streets was awarded to Chas. Bird.

Rochester, N. Y.—The contract for building a sewer in Wolcott st. was awarded to the John Petrossi Co. for $4,336.

Bay City, Mich.—The contract for constructing a 10-in. socket tile sewer in Washington ave. was awarded to Thomas Morrison.

Chicago, Ill.—The Federal Improvement Co. has been awarded a contract for constructing a sewer in S. 52nd ave., for $288,240.

Lubbock, Tex.—The contract for constructing a sanitary sewer system and a septic tank was awarded to O. Leon Dalton, of Dallas.

Elmwood, O.—The contract for constructing a sewerage system was awarded to Paul Menges for $30,546.08, and $15,482 for the disposal plant.

Goshen, Ind.—The contract for constructing 25 mis. of ditch in Hamilton Co. was awarded to the Elkhart Construction Co., of Elkhart, for $60,000.

Houston, Tex.—The contract for constructing a sanitary sewer in the 5th ward was awarded to Kelso & Vautrin, of Galveston, for $72,726.35.

Oklahoma City, Okla.—The Tulsa Engineering and Construction Co., of Tulsa, Okla., was awarded the contract for constructing certain sewers in Deep Fork addition.

Rock Island, Ill.—The contract for building a sewer system in the 6th ward was awarded to the People's Construction Co., of Davenport, for $47,580.56.

Wichita, Kans.—Sewer contracts have been awarded as follows: College Hill, John Shiffler, of Springfield, Mo., $119,279.81; Riverside, Ely Construction Co., of Wellington, $36,107.88.

Minneapolis, Minn.—The contract for construction of sanitary sewers was awarded to the R. J. & W. M. Boyd Construction Co., 200 Southwest Boulevard, Kansas City, Mo., for $27,928.

Providence, R. I.—The contract for constructing a sewer system in the Watchemoket section of East Providence was awarded, Dec. 8, to A. G. Tommasito, of Dorchester, Mass., for $64,844.80.

Detroit, Mich.—Contracts for constructing the new Fairview sewer were awarded, Dec. 17, as follows: 1st section, 1,761 ft., James Pauley, $24,644.38; 2nd section, 3,700 ft., Langley Jeynes, $46,665.

Grand Rapids, Mich.—The contract for constructing a sewer in Walker ave. was awarded to Verhey & Kloet for $23,743.84. Kloote & Vanderveen secured the contract for a sewer in Watkins st. for $646.80.

Arkansas City, Ark.—Special.—Sewer contracts were awarded, Dec. 21, as follows: E. M. Eby, of Wellington, Kans., 3½ mis. 6-in. sewer, 68 cts.; 8-in., 90 cts.; 10-in., $1; 15-in., $1.30; manholes, $40; lampholes, $10; flush tanks, $75; each additional foot of manhole over 6 ft., $3. Robson & Livingston, of city, 900 ft. lateral 6-in. pipe, 65 cts.; manholes, $35; lampholes, $5; flush tanks, $75.

WATER WORKS.

Allen, Tex.—The Allen Water Co. has been incorporated by S. P. Brush, J. Weiley Young and J. M. Hugnley.

Youngstown, O.—The Mill Creek Water Supply Co. has been incorporated to furnish a domestic water supply to the city.

Omaha, Neb.—The Omaha water works case will be argued before the United States Supreme Court at Washington, D. C., early in January.

Carthage, Mo.—The plant of the Carthage Water & Power Co. has been dismantled and closed down, shutting off the city's water supply, as a result of Judge John Phillips' decision in the federal court at Kansas City, in which he denied the right of the city to interfere with G. Ralph Leighton, grantee of the Carthage Water & Power Co. Federal litigation had prevented Leighton from discontinuing the water service Nov. 15, as he announced he would until the decision of Judge Phillips was rendered.

CONTEMPLATED WORK.

Hettinger, N. D.—A water works system is contemplated.

Peru, Neb.—Plans are being prepared for a water works system.

Green Lane, Pa.—Voted to erect municipal water plant.

Callaway, Neb.—The construction of a water supply system is contemplated.

Hibbing, Ill.—The improvement of the water works system is contemplated.

Pluton, Wash.—Plans are being considered for a water works system.

Vandalia, Mo.—Voted to issue bonds for a water works and sewerage system.

Wildon, Colo.—This city contemplates installing 2 more slow sand filters.

Jonesboro, N. C.—Voted to issue bonds for constructing a water works system.

Albany, Ga.—The city council decided, Dec. 7, to install water works.

Albion, N. Y.—The establishment of a new water service is still being urged.

Midland, Tex.—This city voted to issue $50,000 bonds for constructing a water works system.

Calixico, Cal.—The board of trustees contemplates establishing a new municipal water works system.

Wakefield, Kans.—Plans are being prepared for the construction of a water works system.

Texarkana, Ark.—Voted to issue $200,000 bonds for a municipal water works plant.

Foss, Ark.—Voted to issue bonds for constructing a water works and sewerage system.

Guthrie, Okla.—Voted to issue bonds for the improvement of the water system, sewer system, parks and fire service.

Saginaw, Wash.—Council approves the plan of holding an election to vote on the question of reconstructing the water system.

Jackson, Miss.—The city council voted in favor of a $100,000 bond issue for the construction of a filtration plant.

Denison, Tex.—Plans have been prepared for the extension of the water mains south of Day st. and extensions north of Main st.

Norfolk, Va.—Thos. B. Dornin, chief engineer of the water dept., urges a larger and better equipped water supply for this city.

Arkansas City, Ark.—This city contemplates an increased water supply and extension of the water mains. J. H. Matthews, cy. engr.

Kearney, Mo.—Plans and specifications have been completed for the construction of a water works system. G. E. Ford, cy. clk.

El Centro, Cal.—The city trustees will engage the services of an expert engineer to prepare plans and specifications for water works.

Joliet, Ill.—A public hearing will be held Jan. 3 to consider plans, profiles and resolutions for a high-pressure water system.

Oklahoma City, Okla.—Voted to issue bonds for extra pumps, new dam and additional main. Bids will be asked in a few weeks. W. C. Burke, cy. engr.

Conway, Ark.—Special.—The comrs. of water works improvement district No. 1 are prepared to receive bids for an 8-in. deep well. Geo. Watson, secy.

Cuthbert, Ga.—Special.—This city sold $20,000 5 per cent. 30-yr. water and light improvement bonds to John W. Dickey, of Augusta, Ga., for $20,774, accrued interest and printing of bonds.

Lorain, O.—The report of the superintendent of water works on the extension of the water works intake and additional pressure stations for the 4th ward has been accepted by the city council.

CONTRACTS TO BE LET.

Broken Arrow, Okla.—Bids will be received about Feb. 1 for constructing a water works system.

Aberdeen, Wash.—Bids are asked until Jan. 5 for furnishing c. i. pipe and valves. P. T. Clark, cy. clk.

Ft. Robinson, Neb.—Bids are asked until Jan. 3 for alterations to a pump house. Capt. F. L. Arnold, constr. Q. M.

Cawker City, Kans.—Bids are asked until Jan. 11 for constructing a water works system. G. B. McKinley, cy. clk.

Erie, Kans.—Bids will be opened about Jan. 15 or 20 for constructing a water works system. J. C. Denison, cy. clk.

Dodgeville, Wis.—Bids are asked until Jan. 4 for furnishing and erecting a cypress wood or steel tank. Henry Halverson, cy. clk.

Irondequoit, N. Y.—Bids are asked until Jan. 4 for constructing a water works system. J. E. Summerhays, secy. Summerville water dist. in town of Irondequoit.

Vancouver, B. C.—Bids are asked until Jan. 12 for the annual water supply material, including 10 mis. of 12, 8 and 6-in. steel and iron pipe, and 250 tons of 4-in. c. i. pipe. W. A. Clement, cy. engr.

Parkersburg, W. Va.—Bids are asked until Jan. 6 for constructing 37,150 ft. of 6, 8, 10 and 12-in. c. i. pipe for additional water supply, with hydrants, valves and valve boxes. Frank Good, cy. audt.

Lamar, Colo.—Bids are asked until Jan. 9 for constructing a reinforced concrete headgate, reinforced concrete riprapping, etc., at Chivington reservoir No. 4, 2 mis. south of Brandon Station. Chivington Canal Co.

Jackson, Miss.—Bids are asked until Jan. 22 for boring the necessary artesian wells and furnishing machinery for pumping the same for the use of the city water works. Hamilton Johnson, genl. mgr. water works.

New York City.—Bids are asked until Jan. 11 for constructing portions of White Plains division of Catskill aqueduct, including 3 tunnels and about 2½ mis. of plain concrete conduit. J. Waldo Smith, ch. engr. bd. water supply.

Wilmington, N. C.—Bids are asked until Jan. 12 for constructing a brick power and filter house; machinery foundations, rearrangement of machinery, radial brick stack, extension to filter plant, sedimentation basin, and concrete storage reservoir. Chas. W. Worth, chmn. water and sewerage bd.

CONTRACTS AWARDED.

Lubbock, Tex.—The contract for constructing a water works system was awarded to E. Leon Dalton, of Dallas.

Rock Island, Ill.—The contract for laying a water main in Eight-and-a-half ave. was awarded to P. F. Treukenschuh.

San Francisco, Cal.—The contract for constructing Twin Peaks reservoir was awarded to the Healy-Tibbitts Construction Co. for $158,143.

Gotebo, Okla.—The contract for constructing a water works system was awarded to F. C. Brooks & Sons, of Jackson, Mich., Dec. 18, for $24,180.

Lake Village, La.—The contract for constructing a tower, power house and laying water mains was awarded to Justin Matthews, of Little Rock, Ark.

New York City.—The contract for building the Hillview reservoir, below Mt. Vernon and Yonkers, was awarded to the Millard Construction Co., of Philadelphia, for $3,350,000.

Dallas, Tex.—The United States Cast Iron Pipe Co. was awarded the contract for furnishing 5,334 tons of 8 to 36-in. pipe, at $27.70 a ton, and $50 for specials, or a total of $147,750.

Reading, Pa.—The contract for furnishing and erecting pumping machinery at the pumping station at Hampden reservoir was awarded to Fairbanks, Morse & Co., of New York City, for $8,750.

Gulfport, Miss.—The contract for extending the water works system was awarded, Dec. 9, as follows: Fire hydrants, Chattanooga Iron Works; valves and valve boxes, Fairbanks Company, New Orleans; cast iron pipe and special castings, American Cast Iron Pipe Co., Birmingham, Ala.; digging artesian well, Brown Deep Well Co., New Orleans; construction of pumping station, Chevally & Ferguson, Gulfport; screw plugs, Columbia Iron Works, Chattanooga, Tenn.

BRIDGES.

Nashua, N. H.—A new bridge is contemplated to replace Taylors Falls bridge by the city council.

Cohoes, N. Y.—Bids are asked until Jan. 4 for erecting a bridge with concrete floor. Geo. T. Bollin, cy. engr.

Goliad, Tex.—The contract for building a bridge across Blanco river was awarded to J. J. Greathouse for $3,559.

Des Moines, Ia.—A petition will be circulated asking for the construction of a bridge over the Des Moines river at North street.

Geneva, Neb.—Bids are asked until Jan. 11 for erecting all county bridges during the year. Uriah F. Standard, co. clk.

Bristol, Tex.—This city contemplates the construction of an iron bridge across Beaver creek, on Front st. Address mayor.

Portsmouth, Va.—This city contemplates the construction of 3 reinforced concrete bridges during 1910. Bascom Sykes, co. engr.

West Union, O.—Bids are asked until Jan. 17 for constructing a steel bridge with concrete floor. E. C. Zimmerman, co. surveyor.

Ft. Dodge, Ia.—Plans and specifications have been submitted to city council for a viaduct to be constructed at S. 3rd st.

Pensacola, Fla.—Santa Rosa and Escambia counties contemplate the construction of a steel bridge over Escambia river, near McDavid.

Monroeville, O.—Bids are asked until Jan. 24 for erecting a steel riveted truss bridge over Huron river. Jay E. Smith, co. audt.

Florence, Ariz.—Bids are asked until Jan. 15 for constructing a highway bridge

over the Gila river. J. B. Girard, territorial engr., Phoenix.

Pueblo, Colo.—Sealed bids are asked until 4 p. m., Jan. 3, for constructing a bridge across the Arkansas river, at Union ave. D. P. Gaymonecy.

Woonsocket, R. I.—A resolution has been passed providing for the construction of a highway bridge over Blackstone river, at River st., to Cold Spring Park. City council.

Little Rock, Ark.—This city has appropriated $5,000 for the construction of a concrete bridge over Swaggerty branch, on High st. E. A. Kingsley, cy. engr.

Grand Island, Neb.—Bids are asked until Jan. 12 for constructing and repairing all steel, wooden, pile and truss bridges for 1 yr. G. H. Poell, co. clk.

Cincinnati, O.—Bids are asked until Jan. 7 for the repair of the east abutment of the bridge over the Little Miami river, on the New Richmond pike, Anderson twp. Stanley Struble, prest. co. comrs.

Dallas, Tex.—Sealed bids are asked until Jan. 15 for constructing a steel highway bridge and viaduct over Trinity river, about 5 mls. south of this city. Geo. L. Fearn, co. audt.; J. F. Witt, co. engr.

Lamar, Wash.—Bids are asked until Jan. 4 for constructing a bridge on concrete piers and abutments, with retaining walls, across Touchet river, at the Harve Shaw crossing, near here. J. N. McCarr, co. audt.

Winnipeg, Man.—Bids are asked until Jan. 18 for removing the present superstructure and erecting a new superstructure and floor complete for Louise bridge, across Red river. M. Peterson, secy. bd. control.

STREET LIGHTING.

Vine Grove, Ky.—The construction of an electric light plant is contemplated.

Winchester, Tenn.—Bonds for improving the municipal electric light plant have been sold.

North Syracuse, N. Y.—Plans are being considered for lighting the streets of this village.

Essex, Mass.—The question of lighting the streets by electricity is under consideration.

Athens, Mich.—The plant of the Athens Electric & Power Co. was destroyed by fire Dec. 12.

Pocahontas, Ia.—Will vote, Jan. 14, on the issue of bonds for constructing a lighting and heating plant.

Northfield, Vt.—The extension of the municipal electric light system to Northfield Junction is contemplated.

Salt Lake City, Utah.—Plans are being considered for constructing a municipal electric light plant. John S. Bransford, mayor.

Colorado Springs, Colo.—Plans are being considered for constructing a new electric light and power plant here.

Oak Park, Ill.—Plans are being prepared for an addition to the power plant of the Oak Park Light, Heat & Power Co.

Princeton, N. J.—The borough council is considering plans for the improvement of the lighting system.

Charleston, Miss.—Improvements are contemplated for the municipal electric light, water works and sewerage systems.

Terra, Alta.—An electric light plant will be established by J. A. Martin, who is having plans made for a power house.

Hill City, Kans.—The question of constructing an electric light plant is under consideration. A. G. Morris, cy. clk.

Brockport, N. Y.—A. L. Swett, of Medina, has purchased the Albion electric light and power plant, which supplies this village with electricity.

Greenville, Ga.—Bids are asked until Jan. 4 for the purchase of bonds for the purpose of installing a lighting plant, a sewerage system and a water works plant.

Fargo, N. D.—Bids are asked until Jan. 5 for furnishing and installing an electric light plant at the county hospital. Arthur G. Lewis, co. audt.

Ft. Williams, Me.—Bids are asked until Jan. 20 for constructing and remodeling an electric light system here. Capt. C. F. Humphrey, Jr., constr. Q. M.

Chehalis, Wash.—Special.—The town council has under consideration the matter of changing from the arc system of lighting to incandescent. H. C. Coffman.

Los Angeles, Cal.—A resolution has been adopted providing for the construction of a municipal electric plant in connection with the Owens river project. H. J. Lelande, cy. clk.

Canandaigua, N. Y.—The installation of an electric light plant at the court house for the use of the court house and jail has been recommended by the board of supervisors and committee.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Portland, Ore.—Bids are asked until Jan. 3 for constructing a new garbage crematory. Cy. audt.

Buffalo, N. Y.—Special.—Wannenwetsch & Co., Citizens' Bank Bldg., desire the names and addresses of the manufacturers and builders of incinerating plants.

PARKS.

Bayonne, N. J.—The Hudson county park commission has selected two sites for county parks in this city.

Glen Ridge, N. J.—Mayor Mead has decided in favor of transferring the park lands in this borough to the Essex park commission.

Knoxville, Tenn.—An ordinance has been passed providing for the issue of $50,000 bonds for park purposes. John M. Brooks, mayor.

FIRE APPARATUS.

Quincy, Ill.—The purchase of a new fire engine is contemplated.

Peoria, Ill.—A practical illustration of the working of the Gamewell fire alarm telegraph system will be made in this city.

Minneapolis, Minn.—The fire committee of the council has recommended that bonds be sold for the purchase of new fire apparatus.

Springfield, Mass.—The contract for installing a new fire alarm telegraph system in the new fire headquarters in Dwight st. was awarded to the Gamewell Fire Alarm Telegraph Co., of New York City, for $30,000.

Gulfport, Miss.—The contract for installing a fire alarm system was awarded to the Gamewell Fire Alarm Telegraph Co., of New York City, for $3,500.